Enfora Mobile Tracker

Event Cookbook

GSM2000CB001

Revision: 1.02

11/13/2009

GENERAL

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1 Introduction

1.1 OBJECTIVE

The intent of this document is to provide information that details the steps necessary to configure the Enfora® Mobile Tracker LED interface.

1.2 SUPPORTED DEVICES

- GSM2203 MT-G
- GSM2208 MT-G
- GSM2218 MT-GL
- GSM2238 MT-µL

Note: Some features may not be available on some hardware or firmware revisions. Please consult the applicable hardware documentation and firmware release notes.

1.3 EQUIPMENT NEEDED

In this example the requirements are:

- An Enfora® MT series modem
- A notebook or desktop computer with any version of Microsoft Windows that has the HyperTerminal communications program. If this hardware is not available, the user could use a DOS terminal emulation program or DUMB ASCII terminal.

1.4 REFERENCES

- GSM2208AN001 MT-G Quick Start
- GSM2000PB002MAN Enfora® MT-G Hardware User Manual
- GSM2218AN001 MT-GL Quick Start Guide
- GSM2218PB001MAN Enfora® MT-GL Hardware User Manual
- GSM2000PB001MAN Enfora® Mobile Tracker Software User Manual
- GSM0107PB001MAN Enabler-IIG AT Command Set
- GSM0000AN015 Event Monitor and Reporting Overview
- GSM0000AN016 How to Send an SMS Message to an E-Mail Address

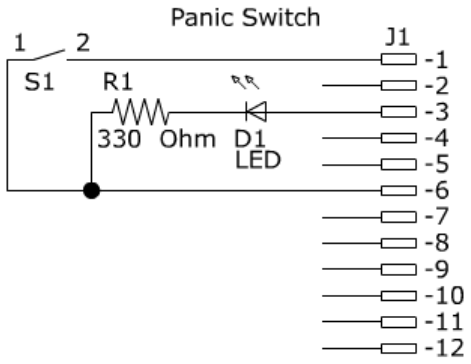
1.5 PROCEDURES

Note: Please note that the following event commands are examples only. When implementing, use the command AT$EVENT? to query the event table and use the next sequential event group number. Failure to do so could potentially cause unpredictable results.

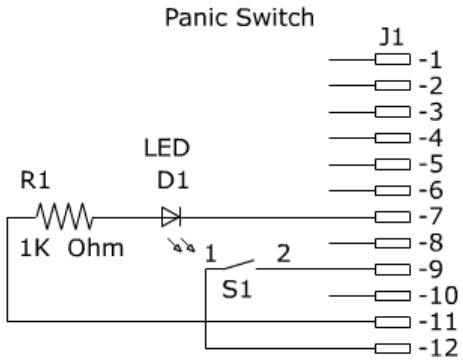
Some of these examples require that communication is established with a remote server. Read and understand the appropriate Quick Start Guide for your device prior to attempting these examples. Always verify that the local serial connection session is actually established with the Enfora® Mobile Tracker modem.

2 Mobile Tracker Test Wiring Diagrams

The following diagrams detail additional wiring that will be required to validate some of these examples.



MT-G



MT-GL

3 Mobile Tracker LED Definitions

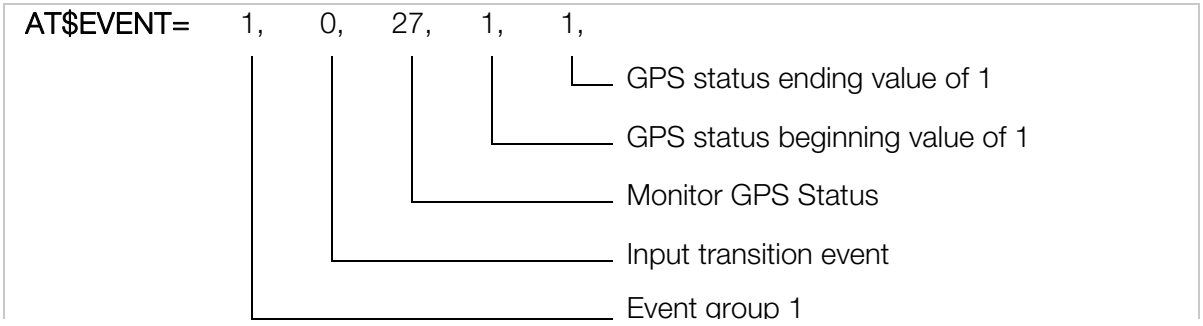
There are a total of three LEDs on the Enfora® Mobile Trackers.

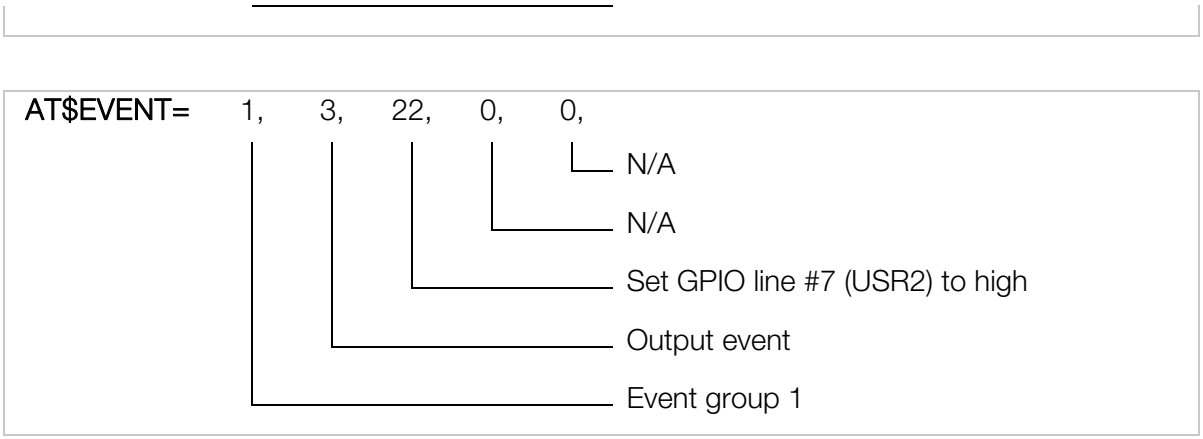
- The power LED reflects the state of the power supplied to the unit. The user cannot change the power LED functionality.
- The other two LEDs are user-configurable and can be changed from the factory default definitions.

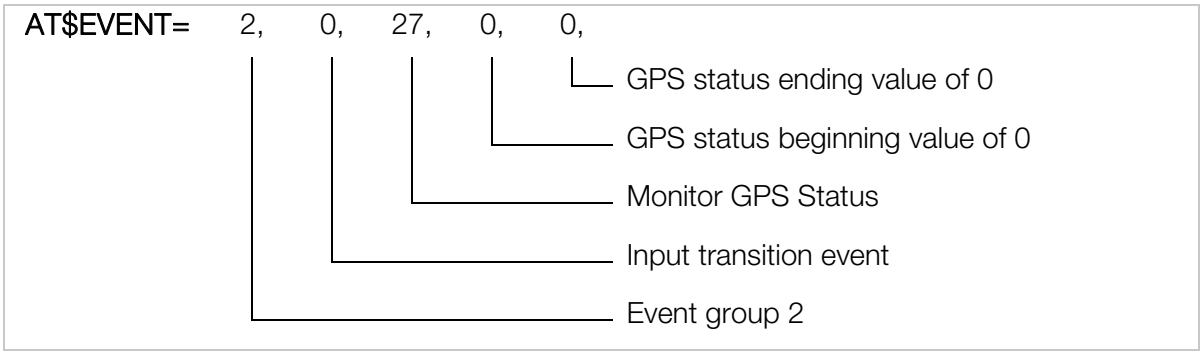
The following displays the factory default settings.

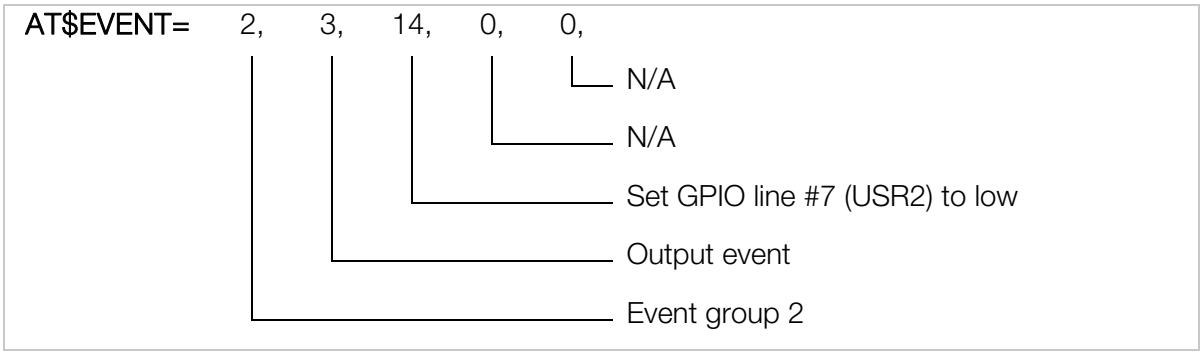
- Power LED display:
  - LED ON when power line connected to the device
  - LED OFF when the device is in low power mode or power is disconnected from the unit
- Registration LED display (USR1):
  - LED OFF when unit is not registered or not trying to register
  - LED blinking when unit is trying to register with the network
  - LED solid ON when GSM is connected
- GPS Fix LED display (USR2):
  - LED OFF when a GPS fix has not been acquired
  - LED solid ON when GPS fix has been acquired

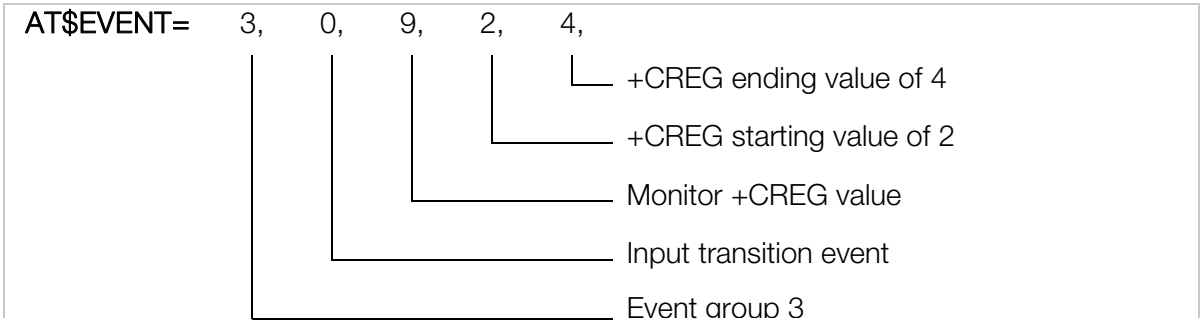
The LED's on the Enfora® Mobile Trackers are controlled by the event processing capability provided in the AT command structure. The following AT command settings provide an example of the use of event processing to reflect registration and GPS statuses. This example uses the actual I/O line 6 (GPIO6 / USR1) for the Registration LED. The other user configurable LED uses I/O line 7 (GPIO7 / USR2).




AT$EVENT= 1, 3, 22, 0, 0,
N/A
N/A
Set GPIO line #7 (USR2) to high
Output event
Event group 1


AT$EVENT= 2, 0, 27, 0, 0,
GPS status ending value of 0
GPS status beginning value of 0
Monitor GPS Status
Input transition event
Event group 2


AT$EVENT= 2, 3, 14, 0, 0,
N/A
N/A
Set GPIO line #7 (USR2) to low
Output event
Event group 2


AT$EVENT= 3, 0, 9, 2, 4,
+CREG ending value of 4
+CREG starting value of 2
Monitor +CREG value
Input transition event
Event group 3

AT$EVENT= 3, 3, 37, 1, 0,

- 0 — Flash forever
- 1 — Flash at ¼ second intervals
- 37 — Flash GPIO line #6 (USR1)
- 3 — Output event
- 3 — Event group 3

AT$EVENT= 4, 0, 9, 5, 5,

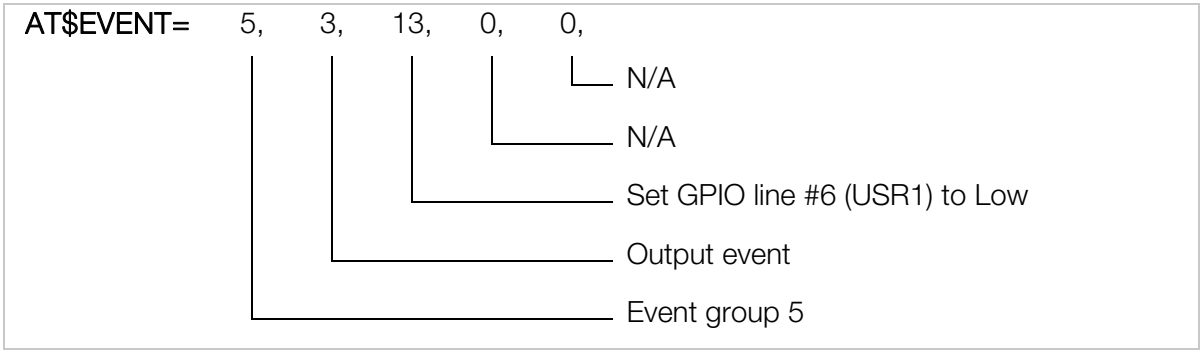
- 5 — +CREG ending value of 5 – Registered on network, Roaming
- 5 — +CREG starting value of 5 – Registered on network, Roaming
- 9 — Monitor +CREG value
- 0 — Input transition event
- 4 — Event group 4

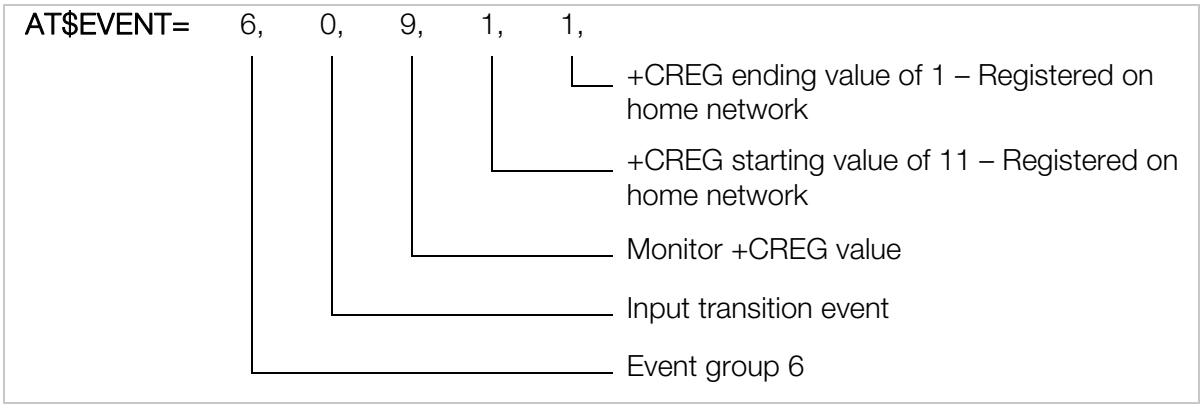
AT$EVENT= 4, 3, 21, 0, 0,

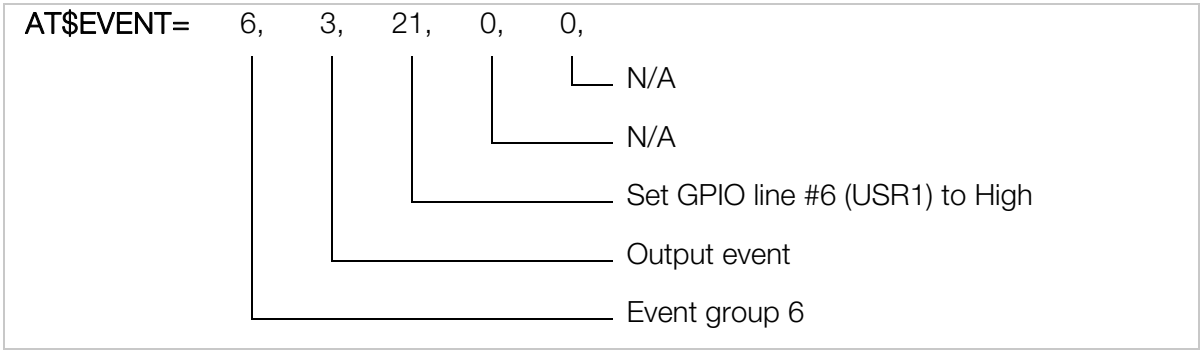
- 0 — N/A
- 0 — N/A
- 21 — Set GPIO line #6 (USR1) to High
- 3 — Output event
- 4 — Event group 4

AT$EVENT= 5, 0, 9, 0, 0,

- 0 — +CREG ending value of 0 – Not Registered
- 0 — +CREG starting value of 0 – Not Registered
- 9 — Monitor +CREG value
- 0 — Input transition event
- 5 — Event group 5







Query the EVENT table:

AT$EVENT?

The table should reflect the following:

$EVENT: evgp evtyp evcat p1 p2

1A	0	27	1	1
1B	3	22	0	0
2A	0	27	0	0
2B	3	14	0	0
3A	0	9	2	4
3B	3	37	1	0
4A	0	9	5	5
4B	3	21	0	0
5A	0	9	0	0
5B	3	13	0	0
6A	0	9	1	1
6B	3	21	0	0

Results:

GPIO pin #6 (USR1) should flash at ¼ second intervals until device is registered on home or roaming networks. Once registered, GPIO pin #6 (USR1) will go high. If registration status is lost, the I/O pin will flash.

4 Pulse Event Configuration

Note: In the following discussion, OFF equals a signal low (0 Vdc) state and ON equals a signal High state.

The Enfora® MT product line contains detailed event processing capability via the AT command structure. The MT modem allows a user to toggle the GPIO line to an On/Off state. The I/O line can pulse in multiples of quarter second (250 ms) increments. The user can select ON time and OFF time (in multiple of 250 ms increments) as desired.

Parameter 1 defines the flash pattern of the LED:

The upper 16 bits (bits 16 – 31) are defined as OFF time while the lower 16 bits (bits 0 – 15) are defined as ON time. If the OFF time is not specified (set to 0), then ON time will be the same as OFF time.

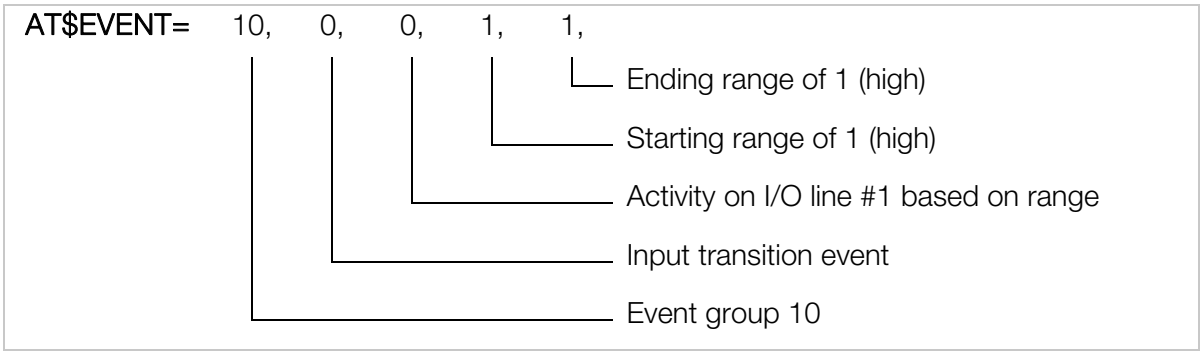
Parameter 2 defines the toggle count.

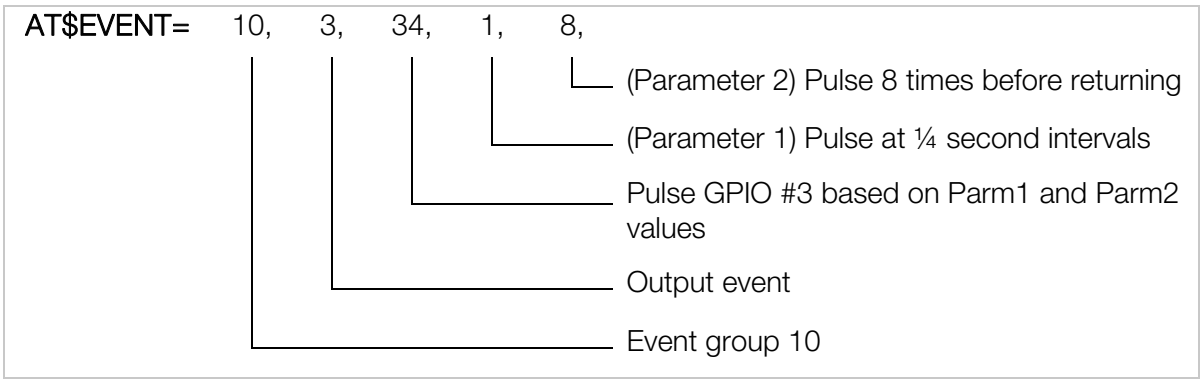
A value of 0 for toggle count means the I/O will be toggled forever. A user can select the number of times the pattern is toggled starting from the current I/O state. The user can select the final state of the I/O line to be either same as the current state or opposite of the current state. To select the final state to be the same as current state, the toggle count should be set to an even number. To select the final state to be opposite of the current state, the toggle count should be set to an odd number.

The following AT command settings provide an example of the use of event processing to toggle an output line based on an input event:

Step 1 - Verify GPIO3 is set to output and GPIO1 is set to input.

1. Send the following command to the modem AT$IOCFG?
2. It should return with something similar to $IOCFG: 11111001 11111001
3. This is the current input/output state of the GPIO pins.
4. The GPIO1 bit will need to set to an output and GPIO3 bit set to an output.
5. The bits that will be changed are 1x0xxxxx where x is bits that are left alone. 1 = input, 0 = output.
6. If AT$IOCFG returned the following $IOCFG: 11111001 11111001 Then the command that will be sent is AT$IOCFG=11011001





Query the EVENT table:

AT$EVENT?

The table should reflect the following:

$EVENT:	evgp	evtyp	evcat	p1	p2
	10A	0	0	1	1
	10B	3	34	1	8

AT$EVTEST (to test this example):

Note: It is the transition from a 0 to a 1 that causes event 9 to fire. In order to perform the test again, both EVTEST commands need to be sent.

AT$IOGP3=	0	Set GPIO3 to be in Low state

AT$EVENT= 0, 0,

- 0 — Event category 0 (Input line 1)
- 0 — Create a low input signal

AT$EVENT= 0, 1,

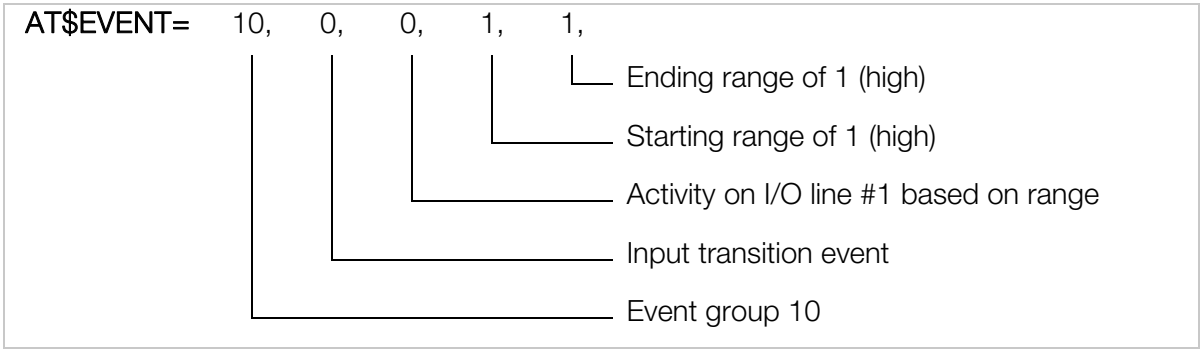
- 0 — Event category 0 (Input line 1)
- 1 — Create a high input signal

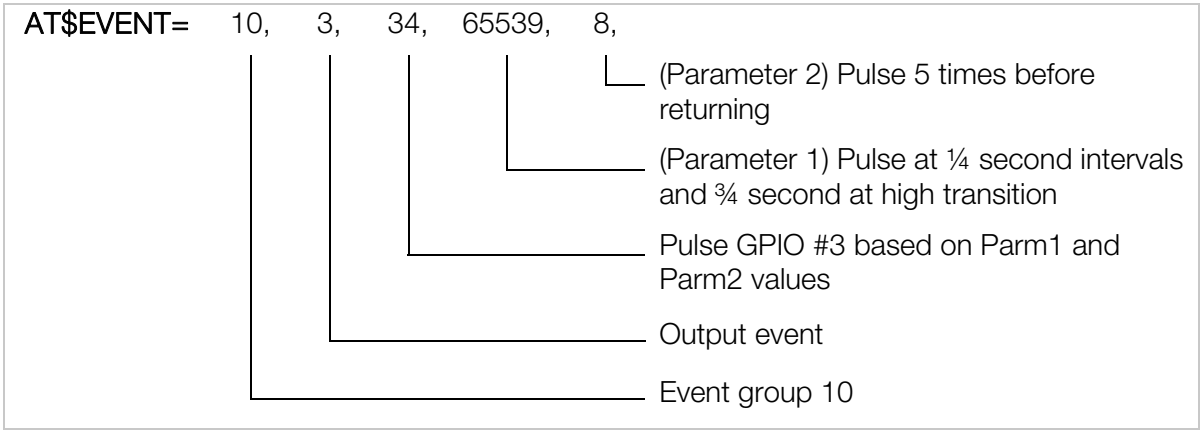
Results:

GPIO pin #3 will toggle 8 times (4 high and 4 low state transitions) at ¼ second intervals each time the AT$EVTEST sequence above is issued.

Note: If Example 1 was entered into the modem, event 10 will need to be deleted prior to performing example 2. Send the following command to delete existing event 10. AT$EVDEL=10

Example 2:





Query the EVENT table:

AT$EVENT?

The table should reflect the following:

$EVENT:	evgp	evtyp	evcat	p1	p2
	10A	0	0	1	1
	10B	3	34	65539	5

Note: The value 65539 for Parm1 is derived as follows:

Bits 0 – 15 describe the High state for the IO. In this example, we have selected the IO to remain in high state for ¾ seconds or 0x0003 (hex) as the lower 16 bits.

Bits 16 – 31 describe the Low state for the IO. In this example, we have selected the IO to remain in low state for ¼ second or 0x0001 (hex) as the upper 16 bits.

When we combine the upper and lower 16 bits, we get: 0x00010003 in hex or 65539 in decimal.

AT$EVTEST (to test this example):

AT$IOGP3=	0	Set GPIO3 to be in Low state

AT$EVTEST= 0, 0,

- 0 — Event category 0 (Input line 1)
- 0 — Create a low input signal

AT$EVTEST= 0, 1,

- 0 — Event category 0 (Input line 1)
- 1 — Create a high input signal

Results:

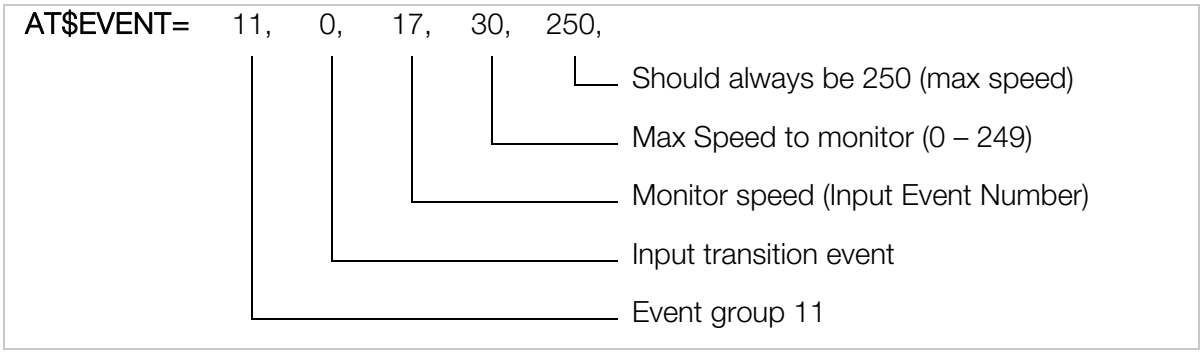
GPIO pin #3 will toggle 5 times (3 high and 2 low state transitions). The IO will initially start with a High state. It will remain in that state for ¾ seconds and then transition to low state for ¼ second. After a total toggle count of 5, the IO will remain in the final state – High (since our starting state was Low). Issue the AT$EVTEST command sequence to observe the results again.

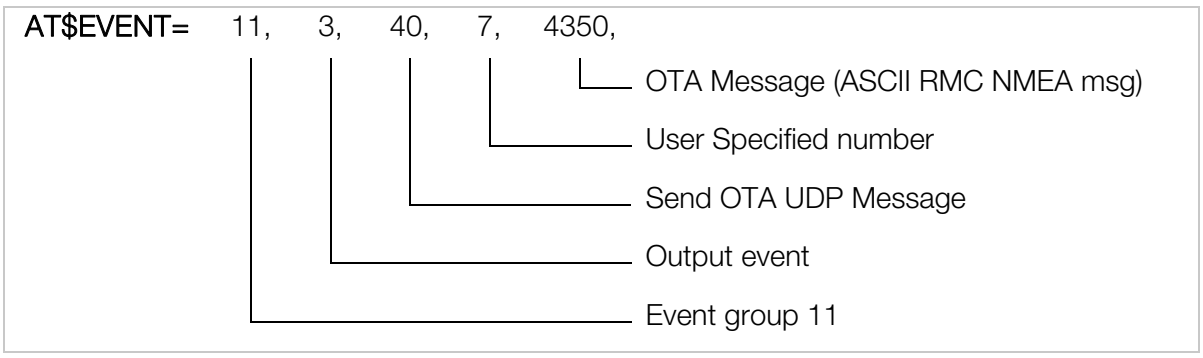
5 Max Speed Exceeded Reporting Configuration

Note: The following examples require the MT device to report to a remote server. If you do not have one configured, refer to the appropriate Quick Start guide to enable communication with Enfora's test server.

Type the following commands to send a GPS RMC NMEA message OTA when MT-G exceeds 30 Knots.

Maximum Speed = 30 (knots) (30 Knots ≈ 35 mph ≈ 56 Km/Hr)





Results:

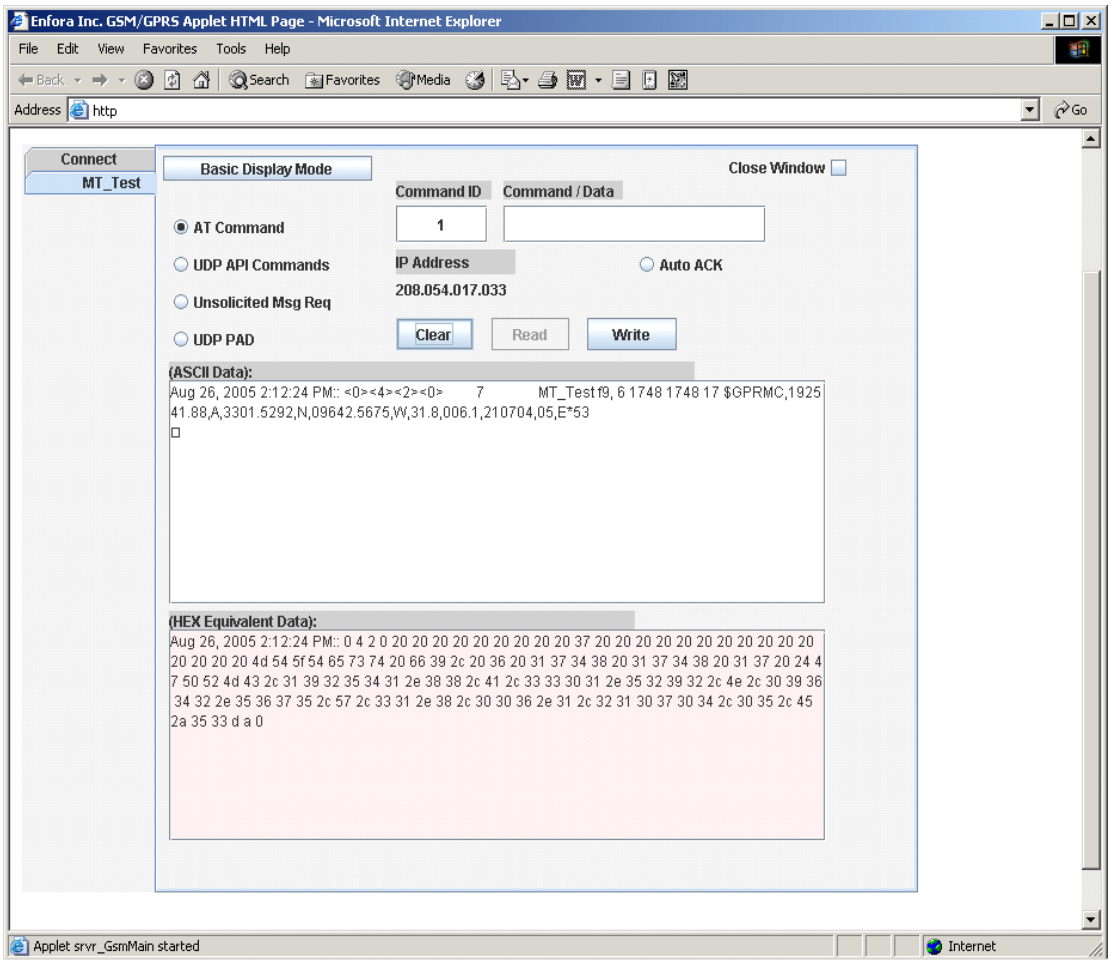
Parameter 2 Decode is as follows:

```
Param2 decode = 4350
Bit 00 > ASCII
Bit 01 > PARAM1 11 bytes ASCII
Bit 02 > MDMID added 22 bytes ASCII
Bit 03 > GPIO 6 bytes ASCII
Bit 04 > A/D1 5 bytes ASCII
Bit 05 > A/D2 5 bytes ASCII
Bit 06 > Store messages if out of GPRS coverage
Bit 07 > Input Event Number 3 bytes ASCII
Bit 08 >
Bit 09 >
Bit 10 >
Bit 11 >
Bit 12 > RMC NMEA Data max 80 bytes ASCII
Bit 13 >
Bit 14 >
Bit 15 >
Bit 16 >
Bit 17 >
Bit 18 >
Bit 19 >
Bit 20 >
Bit 21 >
```

A GPS RMC NMEA message will be sent to the IP address (set by AT$FRIEND) and port number (set by AT$UDPAPI) every time the device exceeds speed of 30 Knots. The MT modem has to go below the set speed of 30 Knots in order to trigger the event again.

The output message format is generated based on the number “4350” set in the second AT$EVENT command.

Below is the example output that would be seen if the modem were setup to report to the Enfora test server.



Described below is the data package that should be received by the server.

- Row 1 indicates the Byte number.

Note: Bytes 0 through 27 are part of IPV4 header. Bytes 28 and greater are the actual packet Payload. Bytes 32 and greater are controlled by the Parameter 2 value.

- Row 2 displays the data in HEX format, and
- Row 3 and/or 4 describe each block of the message.

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9	Byte 10	Byte 11	Byte 12	Byte 13	Byte 14	Byte 15
IP Header data															
IP Header															

Byte 16	Byte 17	Byte 18	Byte 19	Byte 20	Byte 21	Byte 22	Byte 23	Byte 24	Byte 25	Byte 26	Byte 27	Byte 28	Byte 29	Byte 30	Byte 31
				UDP Header data								00	04	02	00
IP Header (contd…)				UDP Header								ASCII GPS data		Status	reserved
												UDP-API Header			

Byte 32	Byte 33	Byte 34	Byte 35	Byte 36	Byte 37	Byte 38	Byte 39	Byte 40	Byte 41	Byte 42	Byte 43	Byte 44	Byte 45	Byte 46	Byte 47
20	20	20	20	20	20	20	20	20	37	20	20	20	20	20	20
User Specified Number (7)								Modem ID							

Byte 48	Byte 49	Byte 50	Byte 51	Byte 52	Byte 53	Byte 54	Byte 55	Byte 56	Byte 57	Byte 58	Byte 59	Byte 60	Byte 61	Byte 62	Byte 63
20	20	20	20	20	20	20	20	20	4D	54	5F	54	65	73	74
Modem ID continued… (MT_Test)															

Byte 64	Byte 65	Byte 66	Byte 67	Byte 68	Byte 69	Byte 70	Byte 71	Byte 72	Byte 73	Byte 74	Byte 75	Byte 76	Byte 77	Byte 78	Byte 79
20	66	39	2C	20	36	2C	20	31	37	34	38	20	31	37	34
Modem ID cont	Mask		comma	Data		space	A/D 1					A/D 2			
	GPIO														

Byte 80	Byte 81	Byte 82	Byte 83	Byte 84	Byte 85	Byte 86	Byte 87	Byte 88	Byte 89	Byte 90	Byte 91	Byte 92	Byte 93	Byte 94	Byte 95
38	20	31	37	20	24	47	50	52	4D	43	2C	31	39	32	35
A/D 2 continued							Input Event Number (17)					ASCII NMEA RMC message ($GPRMC,192541.88,A,3301.5292,N, 09642.5675,W, 31.8,006.1,210704,05 ,E*53)			

Byte 96	Byte 97	Byte 98	Byte 99	Byte 100	Byte 101	Byte 102	Byte 103	Byte 104	Byte 105	Byte 106	Byte 107	Byte 108	Byte 109	Byte 110	Byte 111
34	31	2E	38	38	2C	41	2C	33	33	30	31	2E	35	32	39
ASCII NMEA RMC message continued…															

Byte 112	Byte 113	Byte 114	Byte 115	Byte 116	Byte 117	Byte 118	Byte 119	Byte 120	Byte 121	Byte 122	Byte 123	Byte 124	Byte 125	Byte 126	Byte 127
32	2C	4E	2C	30	39	36	34	32	2E	35	36	37	35	2C	57
ASCII NMEA RMC message continued…															

Byte 128	Byte 129	Byte 130	Byte 131	Byte 132	Byte 133	Byte 134	Byte 135	Byte 136	Byte 137	Byte 138	Byte 139	Byte 140	Byte 141	Byte 142	Byte 143
2C	33	31	2E	38	2C	30	30	36	2E	31	2C	32	31	30	37
ASCII NMEA RMC message continued…															

Byte 144	Byte 145	Byte 146	Byte 147	Byte 148	Byte 149	Byte 150	Byte 151	Byte 152	Byte 153	Byte 154	Byte 155	Byte 156			
30	34	2C	30	35	2C	45	2A	35	33	0D	0A	00			
ASCII NMEA RMC message continued…															

6 Time-Distance Reporting Configuration

Type the following commands to send a GPS RMC NMEA message OTA to a remote Server when time and/or distance settings are violated. Users must use Event Timer 1 ($EVTIM1) for minimum time and Event Timer 2 ($EVTIM2) for maximum time when setting up for this feature. The time and/or distance feature is designed as described in the example table below:

Minimum Time (secs)	Maximum Time (secs)	Distance (meters)	Comments
0	0	0	Feature disabled
0	0	100	GPS message sent every 100 meters
0	60	0	GPS message sent every 60 seconds
0	60	100	GPS message sent every 60 seconds if the vehicle has not moved 100 meters. GPS messages will be sent every 100 meters if the vehicle is moving and traveling the distance of 100 meters in less than 60 seconds. In short, message is sent upon expiration of time or moving of distance – whichever occurs first.
30	x	0	GPS message sent every 30 seconds (x = don't care)
30	0	100	GPS message sent when the vehicle has moved 100 meters and 30 seconds have elapsed.
30	60	100	GPS message sent every 60 seconds if the vehicle is idle and not moving or moving slowly. If the vehicle is moving, then GPS message will be sent when 30 seconds have expired and 100 meters have been moved.

Warning: Choose only one option, from options 1 – 6 below.

Before attempting another option delete the existing events by issuing the following commands:

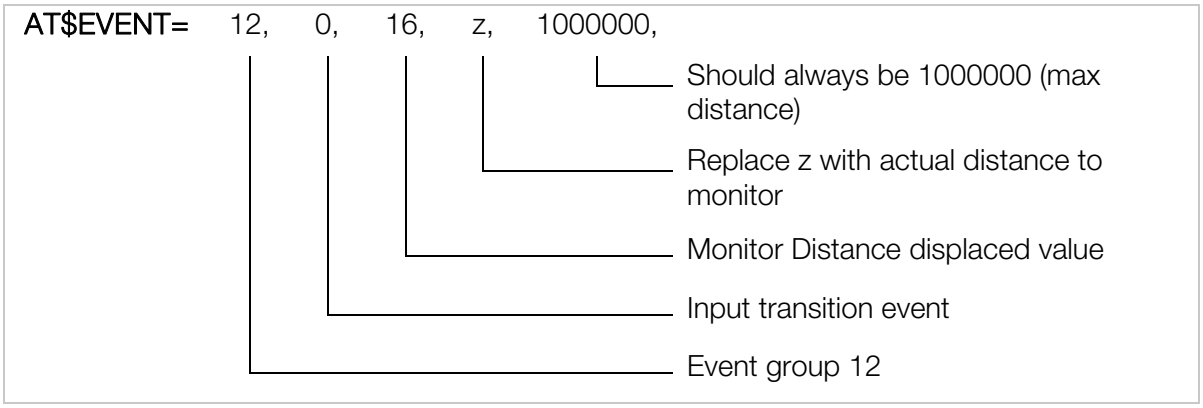
AT$EVDEL=12

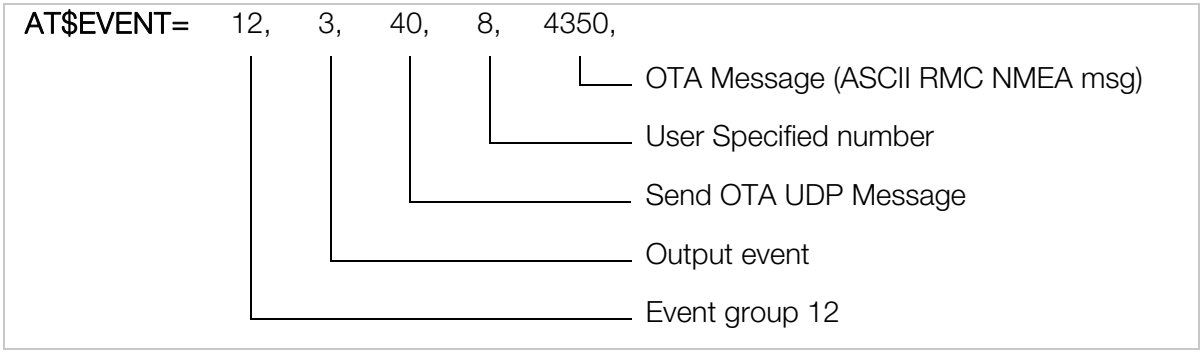
AT$EVDEL=13

The following sections examples of the use of event processing to configure the Time and/or Distance feature.

6.1 SEND GPS MESSAGE WHEN A PREDEFINED DISTANCE IS MOVED.

- Minimum Time = 0
- Maximum Time = 0
- Distance = z (z = 0 – 1000000 meters)





Results:

A GPS RMC NMEA message will be sent to a remote user at every z meters.

6.2 SEND GPS MESSAGE WHEN MAXIMUM TIME EXPIRES.

- Minimum time = 0
- Maximum time = y (y = 0 – 604800 seconds)
- Distance = 0

```
AT$EVTIM2=     y          (y = 0 - 604800 seconds)
```

```
AT$EVENT=   12,   1,   13,   1,   1,
                                   └── Ending range of 1 (high)
                                 └──── Starting range of 1 (high)
                               └────── Activate Timer 2 ($EVTIM2)
                          └─────────── Input occurrence event
                     └──────────────── Event group 12
```

```
AT$EVENT=   12,   3,   40,   8,   4350,
                                   └── OTA Message (ASCII RMC NMEA msg)
                                 └──── User Specified number
                               └────── Send OTA UDP Message
                          └─────────── Output event
                     └──────────────── Event group 12
```

Results:

A GPS RMC NMEA message will be sent to a remote user at every y time interval.

6.3 SEND GPS MESSAGE WHEN MINIMUM TIME EXPIRES.

- Minimum time = x (x = 0 – 604800 seconds)
- Maximum time = 0
- Distance = 0

```
AT$EVTIM1=     x          (x = 0 - 604800 seconds)
```

```
AT$EVENT=   12,   1,   12,   1,   1,
                                  └── Ending range of 1 (high)
                              └────── Starting range of 1 (high)
                          └────────── Activate Timer 2 ($EVTIM1)
                      └────────────── Input occurrence event
                  └────────────────── Event group 12
```

```
AT$EVENT=   12,   3,   40,   8,   4350,
                                  └── OTA Message (ASCII RMC NMEA msg)
                              └────── User Specified number
                          └────────── Send OTA UDP Message
                      └────────────── Output event
                  └────────────────── Event group 12
```

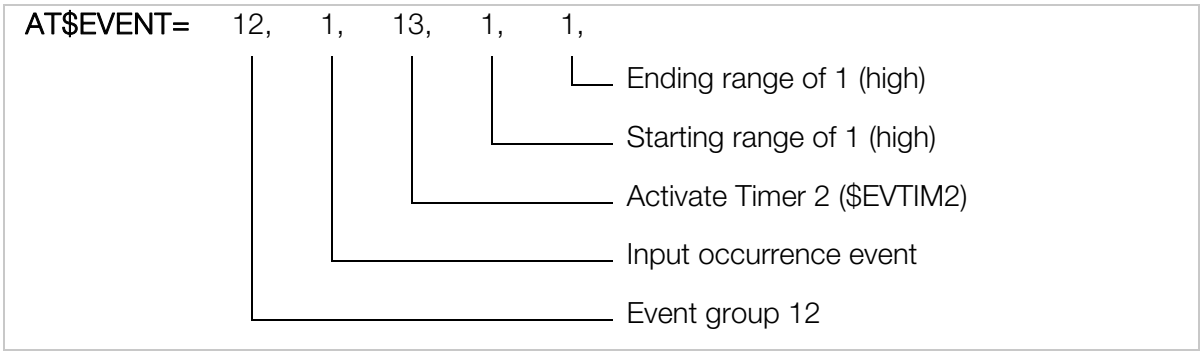
Results:

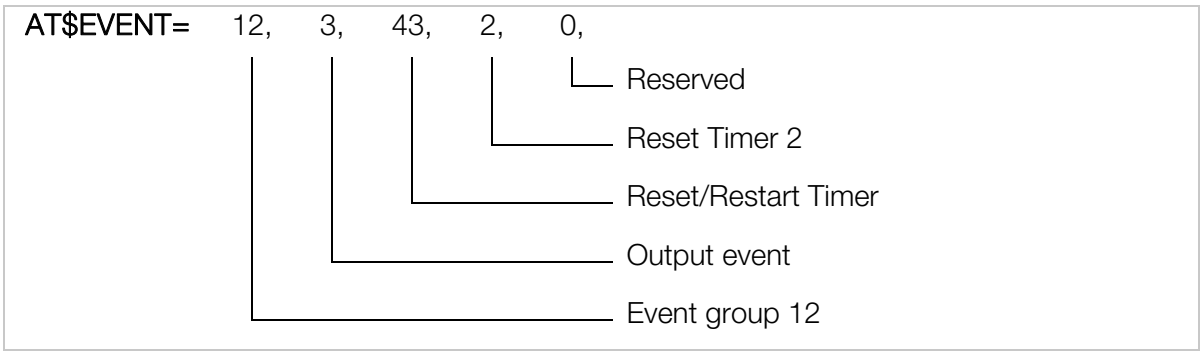
A GPS RMC NMEA message will be sent to a remote user at every x time interval.

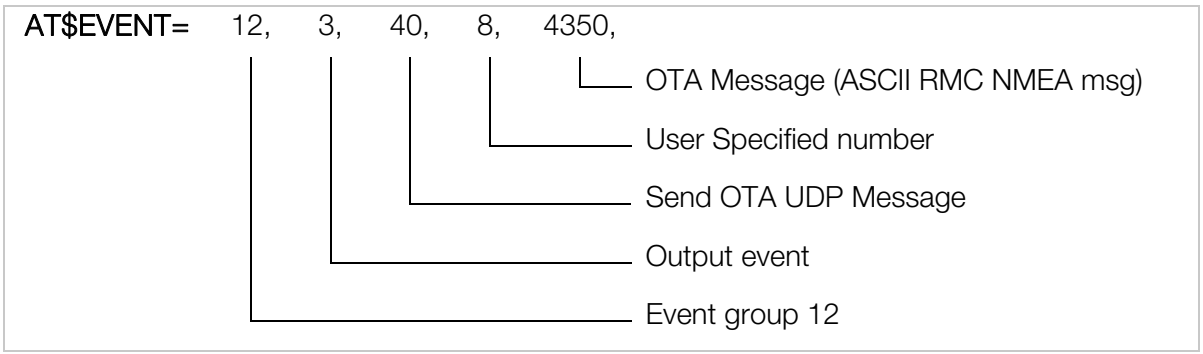
6.4 SEND GPS MESSAGE WHEN TIME OR DISTANCE HAS ELAPSED.

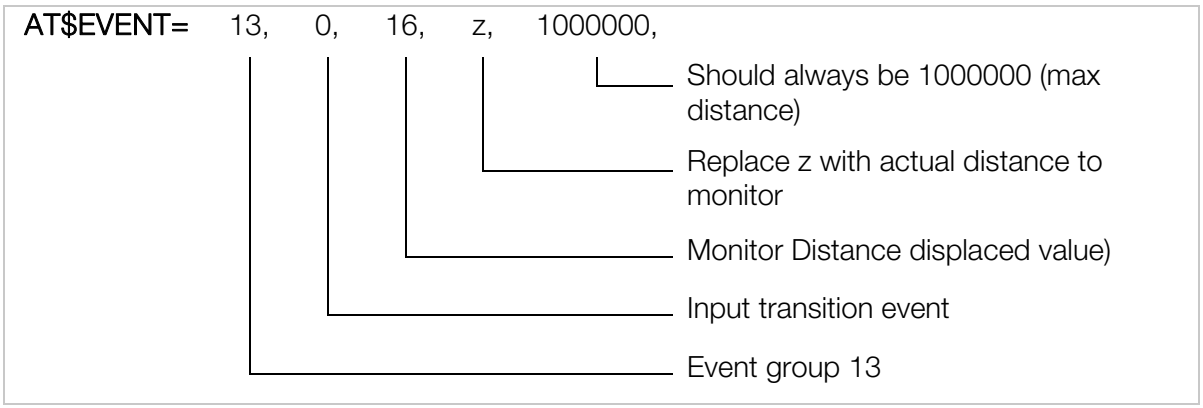
- Minimum time = 0
- Maximum time = y (y = 0 – 604800 seconds)
- Distance = z (z = 0 – 1000000 meters)

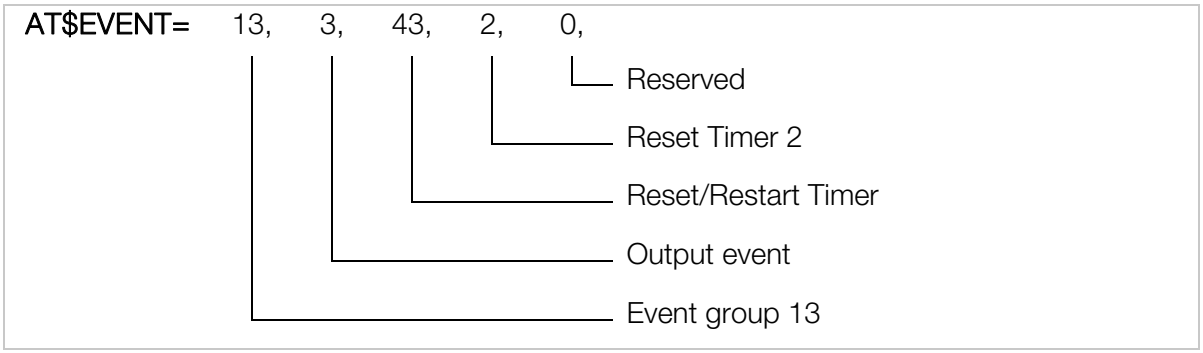
```
AT$EVTIM2=    y          (y = 0 - 604800 seconds)
```

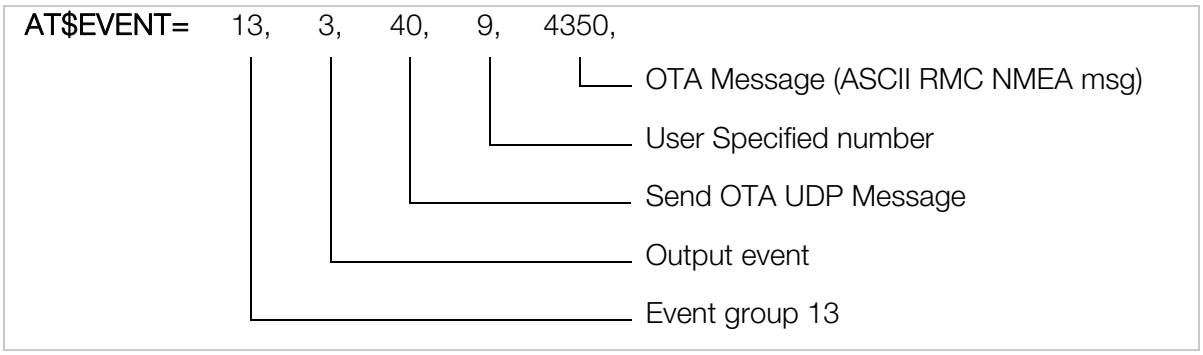












Results:

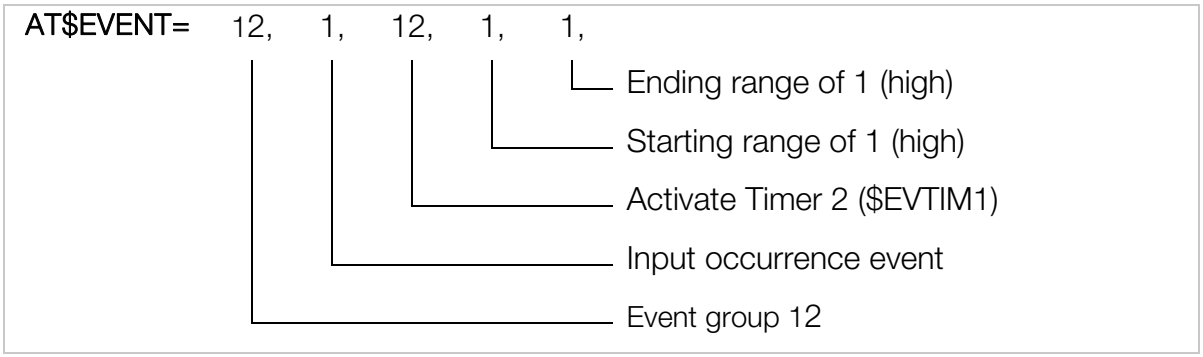
A GPS RMC NMEA message will be sent to a remote user every time the device travels z distance or y time interval has elapsed.

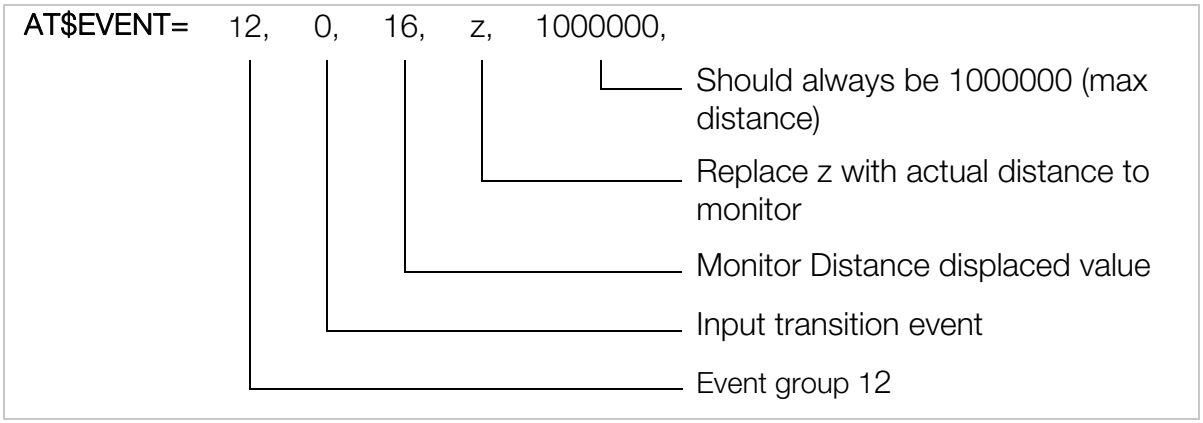
6.5 SEND GPS MESSAGE BASED ON TIME AND DISTANCE.

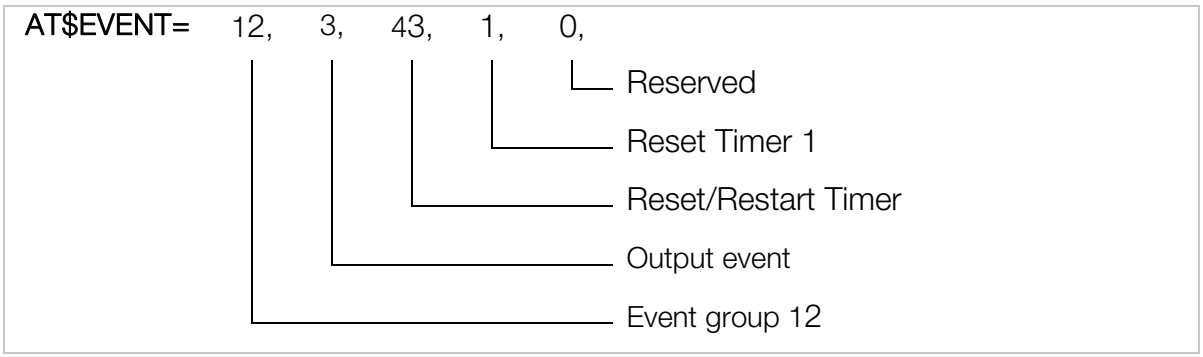
In this instance, a GPS message will not be sent to the remote user until the device travels specified distance and time has expired.

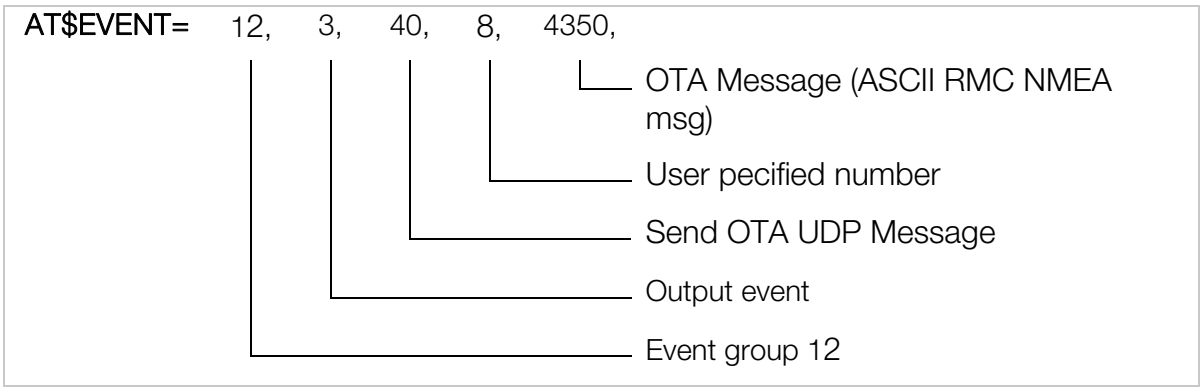
- Minimum time = x (x = 0 – 604800 seconds)
- Maximum time = 0
- Distance = z (z = 0 – 1000000 meters)

```
AT$EVTIM1=    x          (x = 0 - 604800 seconds)
```









Results:

A GPS RMC NMEA message will be sent to a remote user every time the device travels z distance and x time interval has elapsed.

6.6 SEND GPS MESSAGE BASED ON MINIMUM TIME AND DISTANCE OR WHEN MAXIMUM TIME HAS ELAPSED.

In this instance, a GPS message will not be sent to the remote user until the device travels specified distance and minimum time has expired or distance has not been traveled and maximum time has expired.

Note: Maximum Time has to be greater than Minimum Time

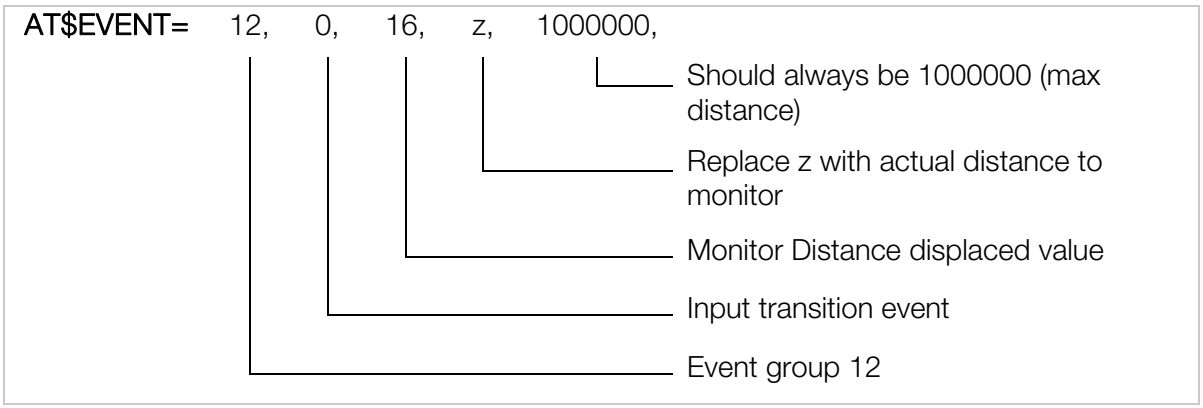
- Minimum time = x (x = 0 – 604800 seconds)
- Maximum time = y (y = 0 – 604800 seconds)
- Distance = z (z = 0 – 1000000 meters)

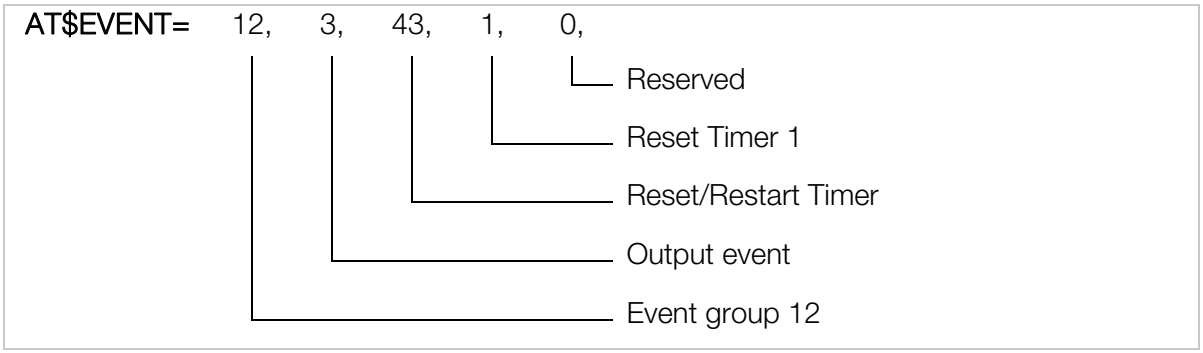
AT$EVTIM1=	x	(x = 0 - 604800 seconds)

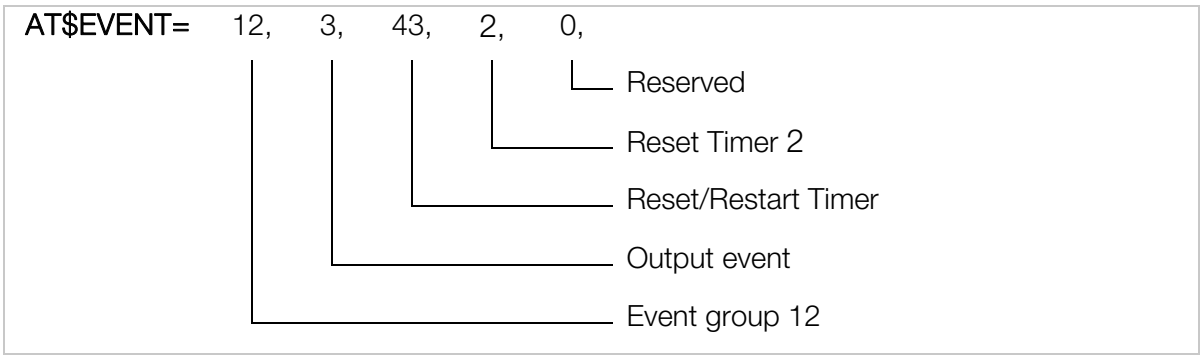
AT$EVTIM2=	y	(y = 0 - 604800 seconds)

AT$EVENT= 12, 1, 12, 1, 1,

- 1, — Ending range of 1 (high)
- 1, — Starting range of 1 (high)
- 12, — Activate Timer 2 ($EVTIM1)
- 1, — Input occurrence event
- 12 — Event group 12


AT$EVENT= 12, 0, 16, z, 1000000,
Should always be 1000000 (max distance)
Replace z with actual distance to monitor
Monitor Distance displaced value
Input transition event
Event group 12


AT$EVENT= 12, 3, 43, 1, 0,
Reserved
Reset Timer 1
Reset/Restart Timer
Output event
Event group 12


AT$EVENT= 12, 3, 43, 2, 0,
Reserved
Reset Timer 2
Reset/Restart Timer
Output event
Event group 12

AT$EVENT= 12, 3, 40, 8, 4350,

- 4350: OTA Message (ASCII RMC NMEA msg)
- 8: User Specified number
- 40: Send OTA UDP Message
- 3: Output event
- 12: Event group 12

AT$EVENT= 13, 1, 13, 1, 1,

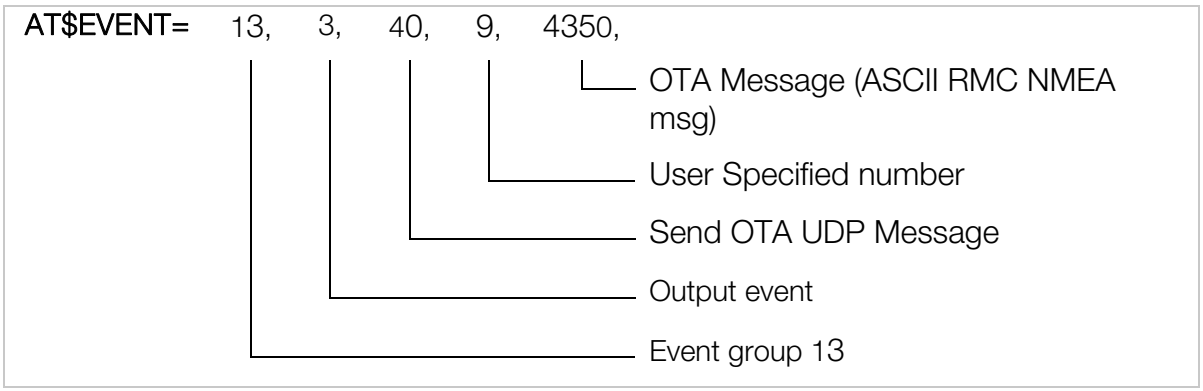
- 1: Ending range of 1 (high)
- 1: Starting range of 1 (high)
- 13: Activate Timer 2 ($EVTIM2)
- 1: Input occurrence event
- 13: Event group 13

AT$EVENT= 13, 3, 43, 1, 0,

- 0: Reserved
- 1: Reset Timer 1
- 43: Reset/Restart Timer
- 3: Output event
- 13: Event group 13

AT$EVENT= 13, 3, 43, 2, 0,

- 0: Reserved
- 2: Reset Timer 1
- 43: Reset/Restart Timer
- 3: Output event
- 13: Event group 13



Results:

A GPS RMC NMEA message will be sent to a remote user every time the device travels z distance and x time interval has elapsed OR y time interval has elapsed

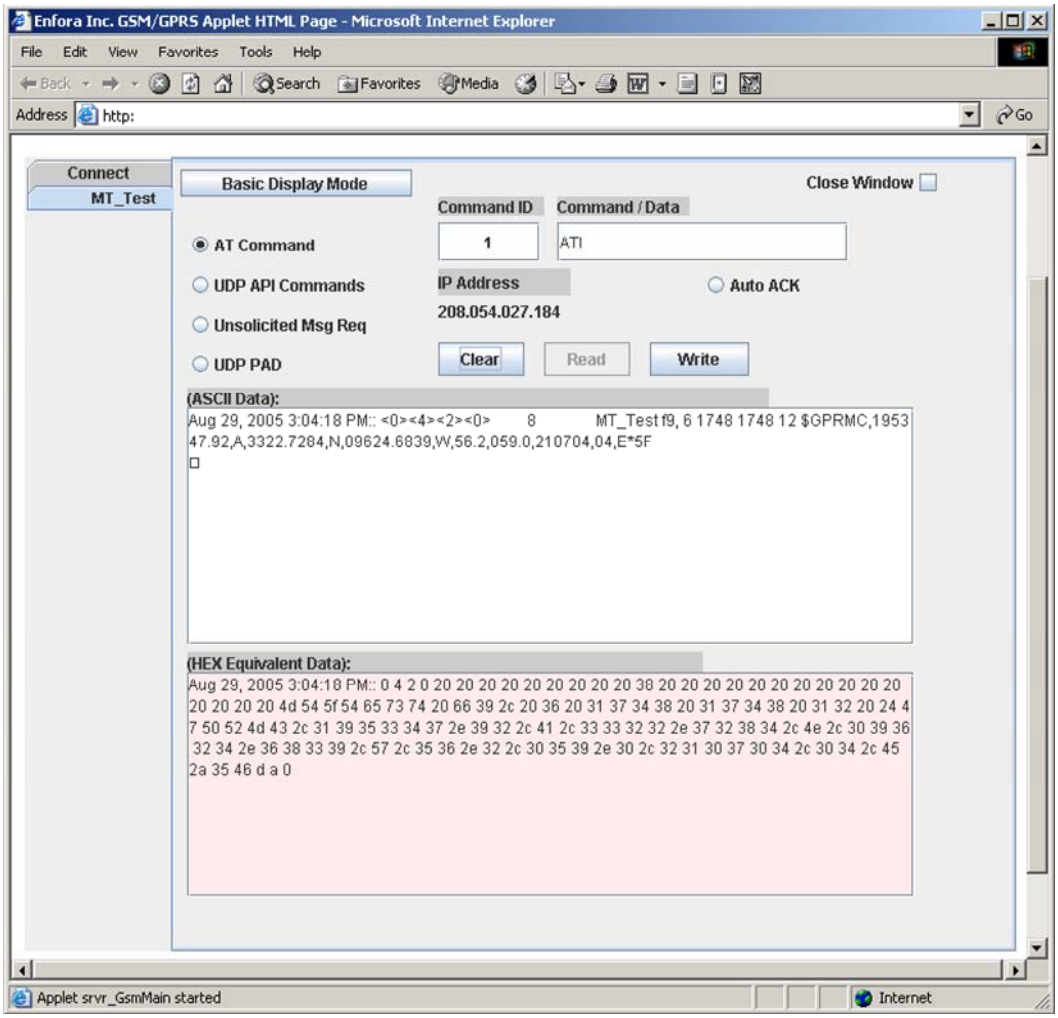
Results:

A GPS RMC NMEA message will be sent to the IP address (set by AT$FRIEND) and port number (set by AT$UDPAPI).

The output message format is generated based on the number “4350” set in section 6.1 above with the AT$EVENT command.

The output message format is generated based on the number “4350” set in the second AT$EVENT command.

Below is the example output that would be seen if the modem were setup to report to the Enfora test server based on example A-3.



Warning: Bytes 32 – 42 and 81 – 83 will change depending on which option (1 – 6) was selected during section a

Described below is the data package that should be received by the Server.

- Row 1 indicates the Byte number.

Note: Bytes 0 through 27 are part of IPV4 header. Bytes 28 and greater are the actual packet Payload. Bytes 32 and greater are controlled by the Parameter 2 value.

- Row 2 displays the data in HEX format, and
- Row 3 and/or 4 describe each block of the message.

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9	Byte 10	Byte 11	Byte 12	Byte 13	Byte 14	Byte 15
IP Header data															
IP Header															

Byte 16	Byte 17	Byte 18	Byte 19	Byte 20	Byte 21	Byte 22	Byte 23	Byte 24	Byte 25	Byte 26	Byte 27	Byte 28	Byte 29	Byte 30	Byte 31
				UDP Header data								00	04	02	00
IP Header (contd…)				UDP Header								ASCII GPS data		Status	reserved
												UDP-API Header			

Byte 32	Byte 33	Byte 34	Byte 35	Byte 36	Byte 37	Byte 38	Byte 39	Byte 40	Byte 41	Byte 42	Byte 43	Byte 44	Byte 45	Byte 46	Byte 47
20	20	20	20	20	20	20	20	20	38	20	20	20	20	20	20
User Specified Number (8)								Modem ID							

Byte 48	Byte 49	Byte 50	Byte 51	Byte 52	Byte 53	Byte 54	Byte 55	Byte 56	Byte 57	Byte 58	Byte 59	Byte 60	Byte 61	Byte 62	Byte 63
20	20	20	20	20	20	20	20	20	4d	54	5f	54	65	73	74
Modem ID continued… (MT_Test)															

Byte 64	Byte 65	Byte 66	Byte 67	Byte 68	Byte 69	Byte 70	Byte 71	Byte 72	Byte 73	Byte 74	Byte 75	Byte 76	Byte 77	Byte 78	Byte 79
20	66	39	2C	20	36	20	31	37	34	38	20	31	37	34	38
Modem ID continued	Mask		comma	Data		space	A/D 1					A/D 2			
	GPIO														

Byte 80	Byte 81	Byte 82	Byte 83	Byte 84	Byte 85	Byte 86	Byte 87	Byte 88	Byte 89	Byte 90	Byte 91	Byte 92	Byte 93	Byte 94	Byte 95

20	31	32	20	24	47	50	52	4d	43	2c	31	39	35	33	34
A/D 2 continued	Input Event Number (12)			ASCII NMEA RMC message ($GPRMC,195347.92,A,3322.7284,N,09624.6839,W,56.2,059.0,210704,04,E*5F)											

Byte 96	Byte 97	Byte 98	Byte 99	Byte 100	Byte 101	Byte 102	Byte 103	Byte 104	Byte 105	Byte 106	Byte 107	Byte 108	Byte 109	Byte 110	Byte 111
37	2e	39	32	2c	41	2c	33	33	32	32	2e	37	32	38	34
ASCII NMEA RMC message continued…															

Byte 112	Byte 113	Byte 114	Byte 115	Byte 116	Byte 117	Byte 118	Byte 119	Byte 120	Byte 121	Byte 122	Byte 123	Byte 124	Byte 125	Byte 126	Byte 127
2c	4e	2c	30	39	36	32	34	2e	36	38	33	39	2c	57	2c
ASCII NMEA RMC message continued…															

Byte 128	Byte 129	Byte 130	Byte 131	Byte 132	Byte 133	Byte 134	Byte 135	Byte 136	Byte 137	Byte 138	Byte 139	Byte 140	Byte 141	Byte 142	Byte 143
35	36	2e	32	2c	30	35	39	2e	30	2c	32	31	30	37	30
ASCII NMEA RMC message continued…															

Byte 144	Byte 145	Byte 146	Byte 147	Byte 148	Byte 149	Byte 150	Byte 151	Byte 152	Byte 153	Byte 154					
34	2c	30	34	2c	45	2a	35	46	0d	0a					
ASCII NMEA RMC message continued…															

7 Geo-Fencing Configuration

The Enfora® Mobile Tracker allows a user to configure maximum of 25 circular shape geo-fences. Enfora® Mobile Trackers can be configured to send GPS messages to a remote user (server) whenever a device enters or exits a geo-fenced area. The geo-fence feature has to be configured with two commands: AT$GEOFNC and AT$EVENT. To configure sending messages when a device enters or exits the geo fenced area, follow the example below:

- NMEA messages provide Latitude and Longitude information in "Degrees Minute.Minute" format.
- To obtain the decimal value for Degrees, take Minute.Minute of the actual Latitude or Longitude and divide it by 60.
- Latitude value should be between –90.0 to +90.0 Degrees
- Longitude value should be between –180.0 to +180.0 Degrees.
- Latitude North of Equator line should always be positive Value.
- Latitude South of the Equator line should always be negative value.
- Longitude East of the GMT line should always be positive.
- Longitude West of the GMT line should always be negative

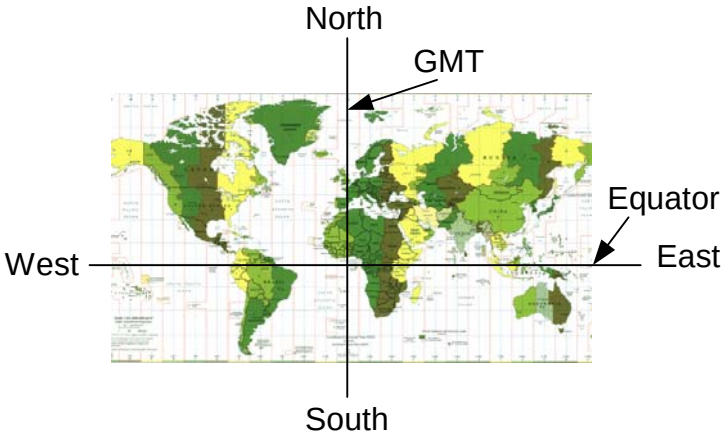


Figure 1 Map of World Displaying Latitude and Longitude

Ex: Send a NMEA RMC GPS message when the Mobile Tracker moves in/out of the geo-fence area 1. Geo fence 1 is a 100 meter radius from the center point defined by Latitude = 33 01.5023 (North) and Longitude = 096 42.3853 (West). According to figure 6 above, Latitude of 33 01.5023 (North) would be a positive value (since its above the Equator line) but Longitude of 96 42.3853 (West) would be a negative value since it is west of the GMT line.

Verify each AT command sent to the modem returns OK.

Radius:	100 meters	
Latitude:	33 01.5023 North	= 33 + 01.5023/60
		= 33.02503833
Longitude:	096 42.3853 West	= -96 + 42.3853/60
		= -96.70642167

```
AT$GEOFNC=          1,100,33.02503833,-96.70642167
```

7.1 SEND A GPS MESSAGE WHEN THE UNIT LEAVES GEO-FENCE 1

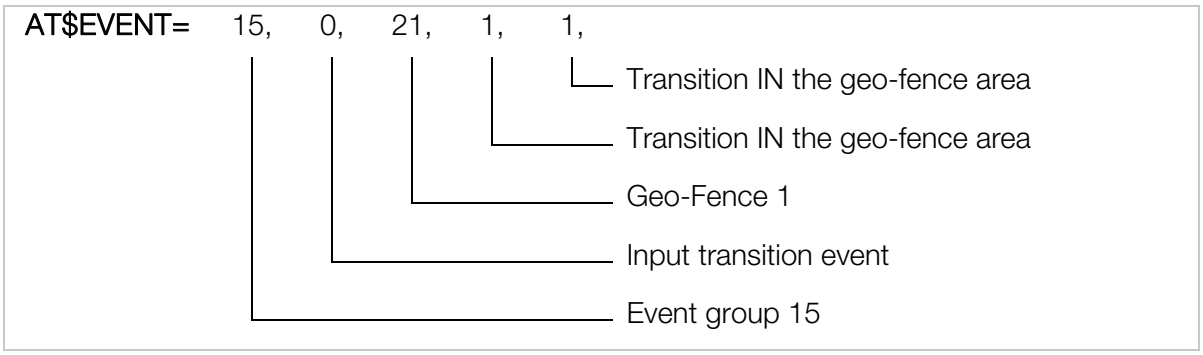
```
AT$EVENT=  14,  0,  21,  0,  0,
```

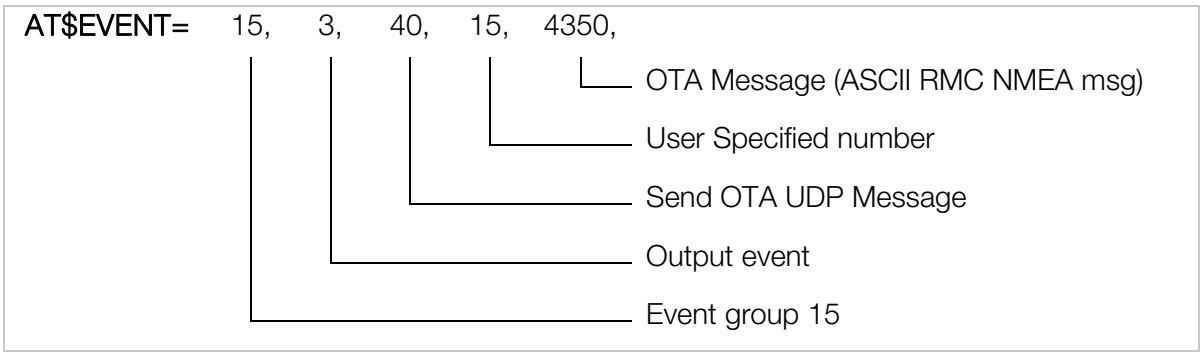
- 0, → Transition OUT of geo-fence area
- 0, → Transition OUT of geo-fence area
- 21, → Geo-Fence 1
- 0, → Input transition event
- 14, → Event group 14

```
AT$EVENT=  14,  3,  40,  14,  4350,
```

- 4350, → OTA Message (ASCII RMC NMEA msg)
- 14, → User Specified number
- 40, → Send OTA UDP Message
- 3, → Output event
- 14, → Event group 14

Send a GPS message when the unit enters geo-fence 1





Results:

A GPS RMC NMEA message will be sent to a remote user every time the device enters or exits the geo fence area.

To add Geo-Fence 2, send the following commands to the MT-G and verify that an OK is returned.

AT$GEOFNC=2,100,34.02503833,-97.70642167

AT$EVENT=16,0,22,0,0

AT$EVENT=16,3,40,16,4350

AT$EVENT=17,0,22,1,1

AT$EVENT=17,3,40,17,4350

For additional Geofences, repeat the 5 commands below by changing the GeoFence (index) number (A), radius (100), latitude (34.02503833), and longitude (-97.70642167) information for AT$GEOFNC command.

And, increment the Event group numbers (B, C), Input Event (D), and User Specified Number (E, F) for AT$EVENT command.

Use the following table for the relationship between the numbers

AT$GEOFNC=A,100,34.02503833,-97.70642167

AT$EVENT=B,0,D,0,0

AT$EVENT=B,3,40,E,4350

AT$EVENT=C,0,D,1,1

AT$EVENT=C,3,40,F,4350

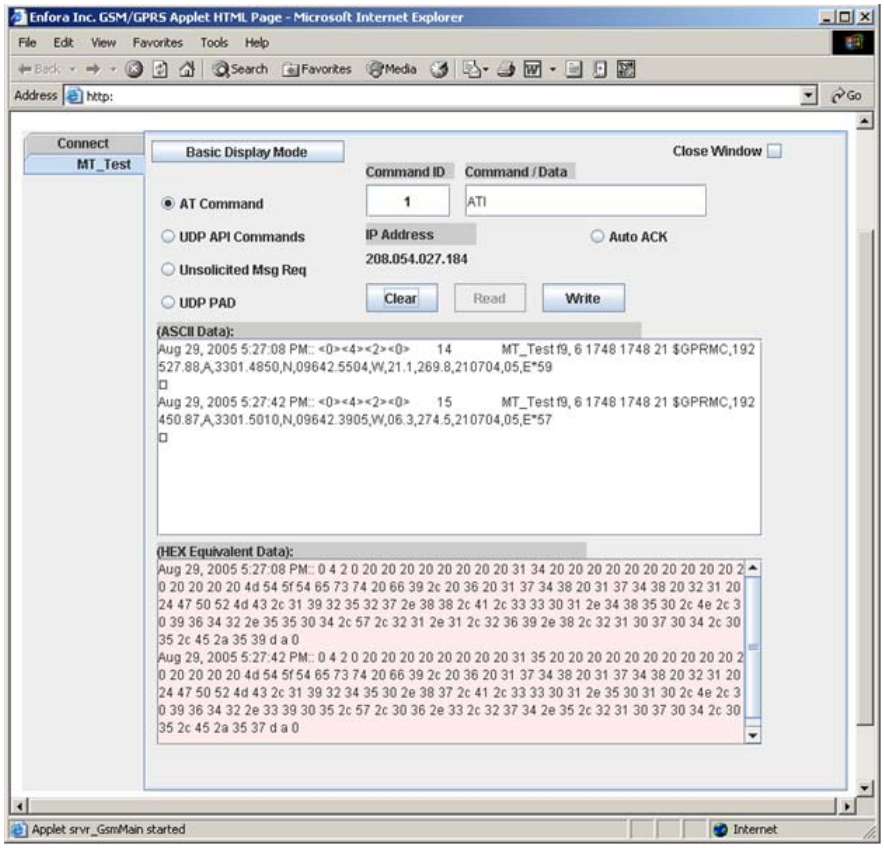
GeoFence	Input Trigger Event number	Leave GeoFence		Enter GeoFence	
		Event	User Number	Event	User Number
A	D	B	E	C	F
1	21	14	14	15	15
2	22	16	16	17	17
3	23	18	18	19	19
4	24	20	20	21	21
5	25	22	22	23	23
6	31	24	24	25	25
7	32	26	26	27	27
8	33	28	28	29	29
9	34	30	30	31	31
10	35	32	32	33	33
11	36	34	34	35	35
12	37	36	36	37	37
13	38	38	38	39	39
14	39	40	40	41	41
15	40	42	42	43	43

16	41	44	44	45	45
17	42	46	46	47	47
18	43	48	48	49	49
19	44	50	50	51	51
20	45	52	52	53	53
21	46	54	54	55	55
22	47	56	56	57	57
23	48	58	58	59	59
24	49	60	60	61	61
25	50	62	62	63	63

Results:

A GPS RMC NMEA message will be sent to the IP address (set by AT$FRIEND) and port number (set by AT$UDPAPI) when it enters or exits a defined geo fence.

The output message format is generated based on the number “4350” set in above example with the AT$EVENT command.



Warning: Bytes 32 – 42 will change depending on what is programmed in the "user specified field". Bytes 81 – 83 will change with geo-fence number

Described below is the data package that should be received by the Server when the modem exits GeoFence 1.

- Row 1 indicates the Byte number.

Note: Bytes 0 through 27 are part of IPV4 header. Bytes 28 and greater are the actual packet Payload. Bytes 32 and greater are controlled by the Parameter 2 value.

- Row 2 displays the data in HEX format, and
- Row 3 and/or 4 describe each block of the message.

Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6	Byte 7	Byte 8	Byte 9	Byte 10	Byte 11	Byte 12	Byte 13	Byte 14	Byte 15
IP Header data															
IP Header															

Byte 16	Byte 17	Byte 18	Byte 19	Byte 20	Byte 21	Byte 22	Byte 23	Byte 24	Byte 25	Byte 26	Byte 27	Byte 28	Byte 29	Byte 30	Byte 31
				UDP Header data								00	04	02	00
IP Header (contd…)				UDP Header								ASCII GPS data		Status	reserved
												UDP-API Header			

Byte 32	Byte 33	Byte 34	Byte 35	Byte 36	Byte 37	Byte 38	Byte 39	Byte 40	Byte 41	Byte 42	Byte 43	Byte 44	Byte 45	Byte 46	Byte 47
20	20	20	20	20	20	20	20	31	34	20	20	20	20	20	20
User Specified Number (14)								Modem ID							

Byte 48	Byte 49	Byte 50	Byte 51	Byte 52	Byte 53	Byte 54	Byte 55	Byte 56	Byte 57	Byte 58	Byte 59	Byte 60	Byte 61	Byte 62	Byte 63
20	20	20	20	20	20	20	20	20	4d	54	5f	54	65	73	74
Modem ID continued… (MT_Test)															

Byte 64	Byte 65	Byte 66	Byte 67	Byte 68	Byte 69	Byte 70	Byte 71	Byte 72	Byte 73	Byte 74	Byte 75	Byte 76	Byte 77	Byte 78	Byte 79
20	66	39	2C	20	36	20	31	37	34	38	20	31	37	34	38
Modem ID cont.	Mask		comma	Data		space	A/D 1					A/D 2			
	GPIO														

Byte 80	Byte 81	Byte 82	Byte 83	Byte 84	Byte 85	Byte 86	Byte 87	Byte 88	Byte 89	Byte 90	Byte 91	Byte 92	Byte 93	Byte 94	Byte 95
20	32	31	20	24	47	50	52	4d	43	2c	31	39	32	35	32
A/D 2 continued					Input Event Number (21)						ASCII NMEA RMC message ($GPRMC,192527.88,A,3301.4850,N,09642.5504,W,21.1,269.8,210704,05,E*59)				

Byte 96	Byte 97	Byte 98	Byte 99	Byte 100	Byte 101	Byte 102	Byte 103	Byte 104	Byte 105	Byte 106	Byte 107	Byte 108	Byte 109	Byte 110	Byte 111
37	2e	38	38	2c	41	2c	33	33	30	31	2e	34	38	35	30
ASCII NMEA RMC message continued…															

Byte 112	Byte 113	Byte 114	Byte 115	Byte 116	Byte 117	Byte 118	Byte 119	Byte 120	Byte 121	Byte 122	Byte 123	Byte 124	Byte 125	Byte 126	Byte 127
2c	4e	2c	30	39	36	34	32	2e	35	35	30	34	2c	57	2c
ASCII NMEA RMC message continued…															

Byte 128	Byte 129	Byte 130	Byte 131	Byte 132	Byte 133	Byte 134	Byte 135	Byte 136	Byte 137	Byte 138	Byte 139	Byte 140	Byte 141	Byte 142	Byte 143
32	31	2e	31	2c	32	36	39	2e	38	2c	32	31	30	37	30
ASCII NMEA RMC message continued…															

Byte 144	Byte 145	Byte 146	Byte 147	Byte 148	Byte 149	Byte 150	Byte 151	Byte 152	Byte 153	Byte 154					
34	2c	30	35	2c	45	2a	35	39	0d	0a					
ASCII NMEA RMC message continued…															

8 Power Save Configuration

Enfora® Mobile Trackers allow a user to configure the device to enter or exit low power mode based on Ignition and/or DTR setting. The Enfora® Mobile Tracker has to be configured via AT commands as well as the hardware has to be wired accordingly to enter low power mode.

8.1 ENTERING POWER SAVE MODE

Select one of the options from 1 thru 6 below for your desired method to enter low power mode.

Note: The MT-Gμ does not have a DTR input. Examples 4,5,6 do not apply to the MT-Gμ. If you are using these examples for MT-Gu, there are only three parameters available (i.e. AT$PWRSAV=<IGNITION>,<TIMEOUT>,<REG>). Please review GSM2338AT001 for correct syntax.

MT-GL/MT-μL require 4 parameters: (i.e. AT$PWRSAV=<DTR>,<IGNITION>,<TIMEOUT>,<REG>)

Note: Example 3 only needs to be used if the MT-G does not automatically reset when Ignition source is applied.

Note: Do not use a delay time of 0 if you are planning to include GPS messages.

1. Enter the following command to put the MT in Low Power Mode immediately when Ignition is turned OFF. The MT should respond back with OK.

```
AT$PWRSAV=0,1,1,0
```

2. Enter the following command to put the MT in Low Power Mode 10 seconds after the Ignition has been turned OFF. The MT should respond back with OK.

```
AT$PWRSAV=0,1,10,0
```

3. Enter the following command to reset the MT when Ignition is turned ON after being in low power mode during Ignition Off. The MT should respond back with OK.

```
AT$PWRSAV=0,1,10,1
```

4. Enter the following command to put the MT-G in Low Power Mode immediately when DTR is disconnected. The MT-G should respond back with OK.

```
AT$PWRSAV=1,0,1,0
```

5. Enter the following command to put the MT-G in Low Power Mode immediately when DTR is disconnected. When DTR is connected, the MT-G will reset. The MT-G should respond back with OK.

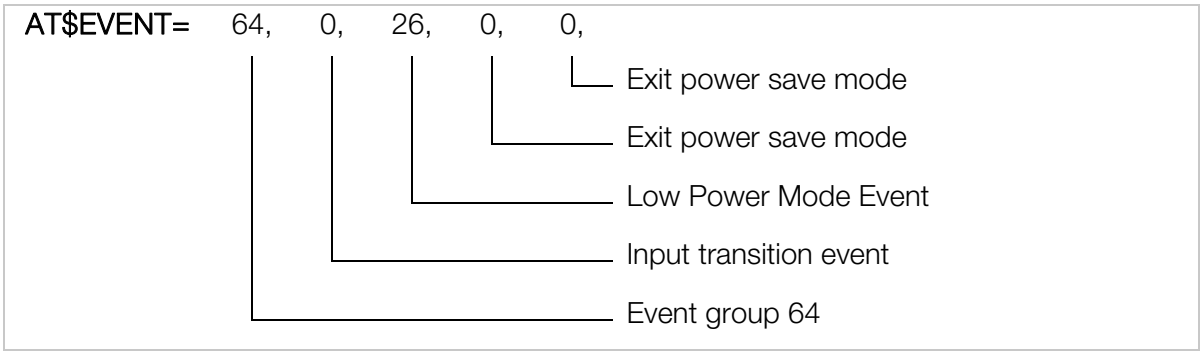
```
AT$PWRSAV=1,0,1,1
```

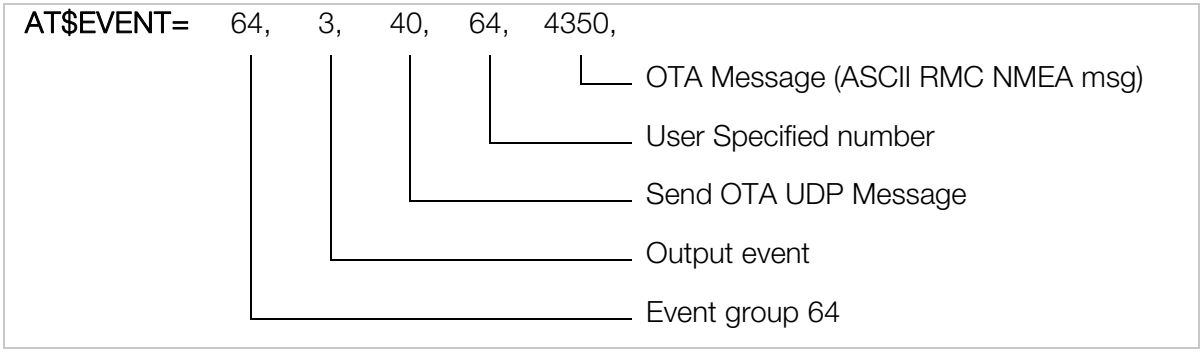
6. Enter the following command to put the MT-G in Low Power Mode 10 seconds after DTR is disconnected and Ignition is turned OFF. The MT-G should respond back with OK.

```
AT$PWRSAV=1,1,10,0
```

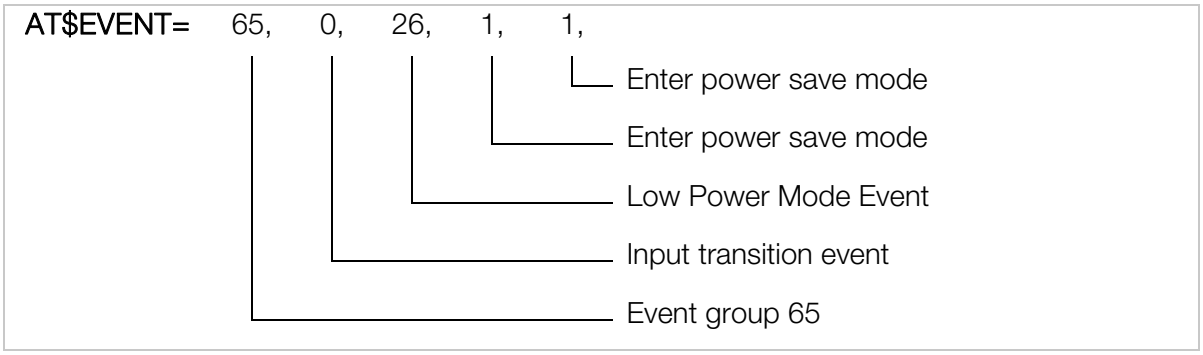
Note: In Low Power Mode, the GPS receiver is turned OFF and hence one would not get any GPS data through the serial port or OTA. However, the modem is still registered and connected to the GSM/GPRS network. A user can also select to get notified when the Enfora® Mobile Tracker enters low power mode or exits Low Power Mode. Use the following AT commands to configure sending of message when the MT enters or exits low power mode.

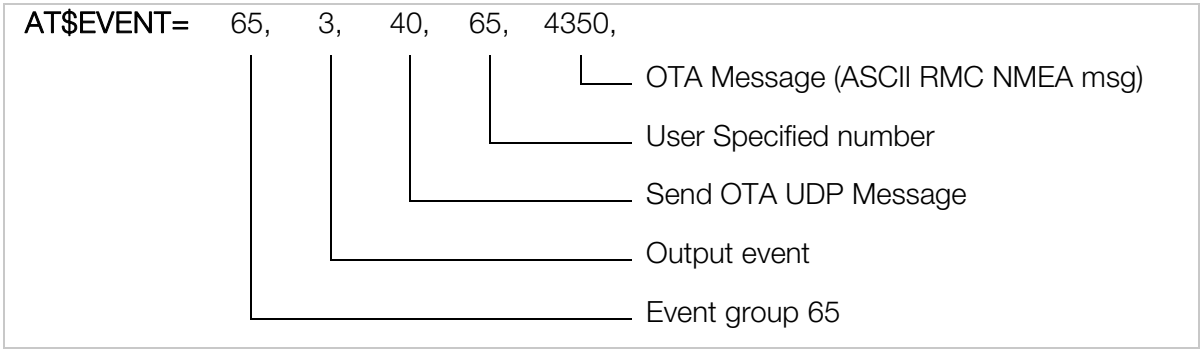
8.2 SEND A GPS MESSAGE WHEN THE ENFORA® MOBILE TRACKER EXITS POWER SAVE MODE





8.3 SEND A GPS MESSAGE WHEN THE MT-G ENTERS POWER SAVE MODE





Results:

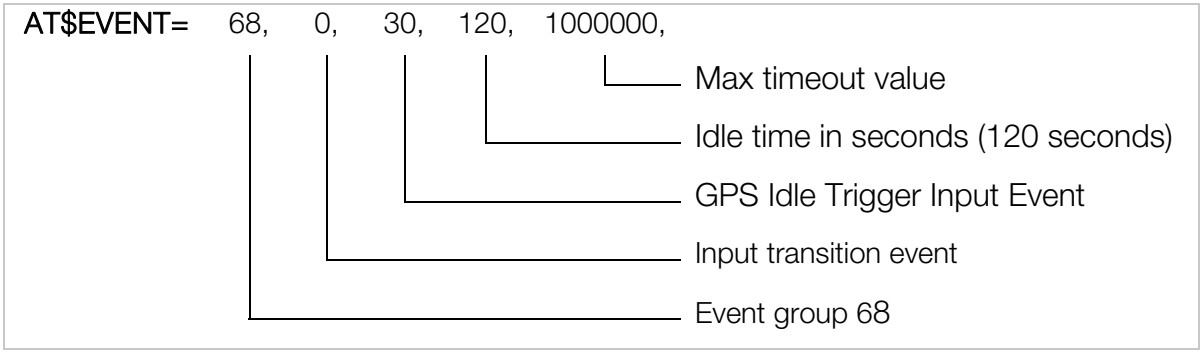
A GPS RMC NMEA message will be sent to a remote user every time the device enters or exits low power mode.

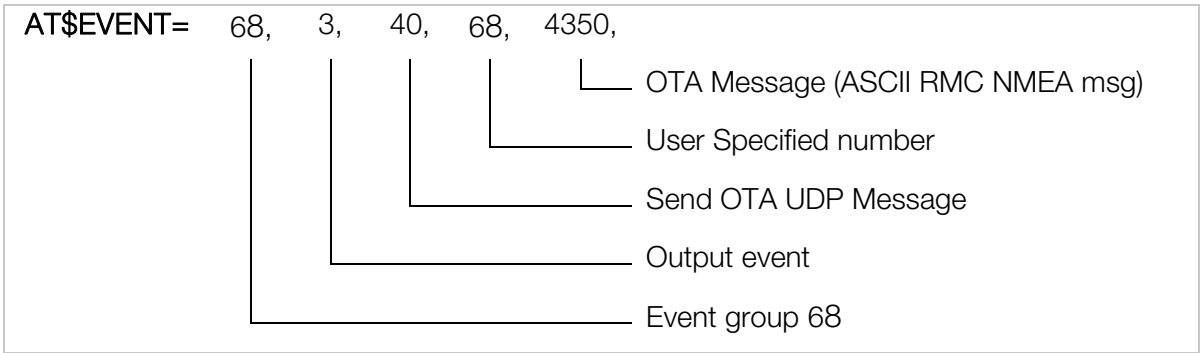
9 GPS Idle Trigger

The Enfora® Mobile Tracker maintains GPS Idle count. The Idle count is incremented every second that the unit has not moved and is stationary in one position. The user can elect to receive a GPS message when the Idle count exceeds. Idle count is measured in seconds.

Note: A GPS Idle Trigger message will only be sent once when the timer expires. The message will not be repeated if the device/vehicle has not moved.

To send a GPS message when the device/vehicle stays idle for 2 minutes (120 seconds), configure as follows:





Query the EVENT table:

AT$EVENT?

The table should reflect the following:

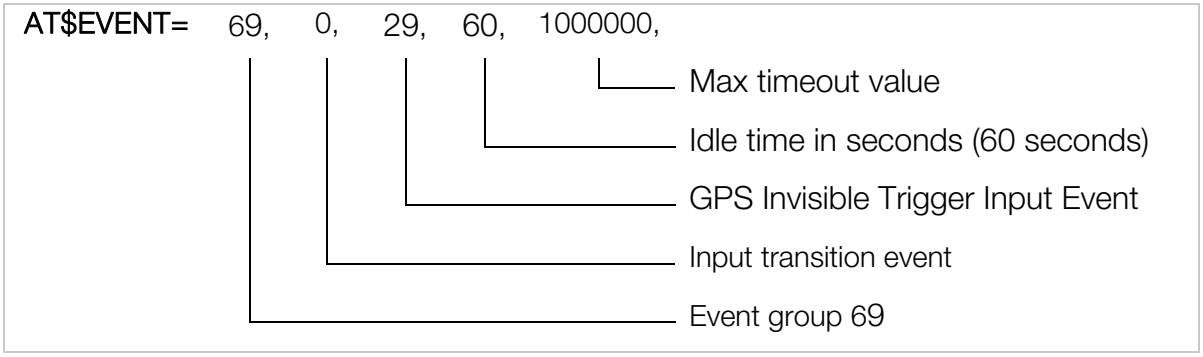
$EVENT:	evgp	evtyp	evcat	p1	p2
	68A	0	30	120	1000000
	68	3	40	68	4350

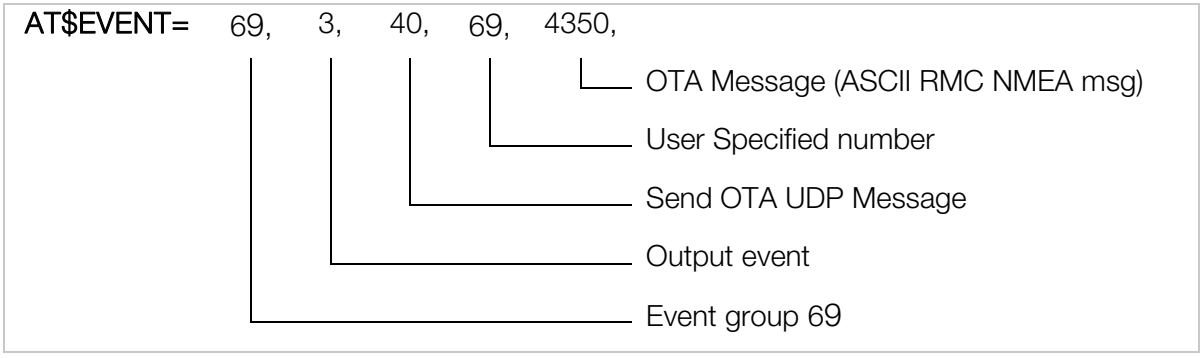
10 GPS Invisible Trigger

The Enfora® Mobile Tracker maintains GPS Invisible count. The Invisible count is incremented every second when the unit does not have valid GPS data. The user can elect to receive a message when the Invisible count exceeds a set period. Invisible count is measured in seconds.

Note: A GPS Invisible Trigger message will only be sent once when the timer expires. The message will not be repeated if the device/vehicle has not acquired valid GPS data.

To send a message when the device/vehicle stays idle for 1 minute (60 seconds), configure as follows:





Query the EVENT table:

AT$EVENT?

The table should reflect the following:

$EVENT:	evgp	evtyp	evcat	p1	p2
	69A	0	29	60	1000000
	698	3	40	69	4350

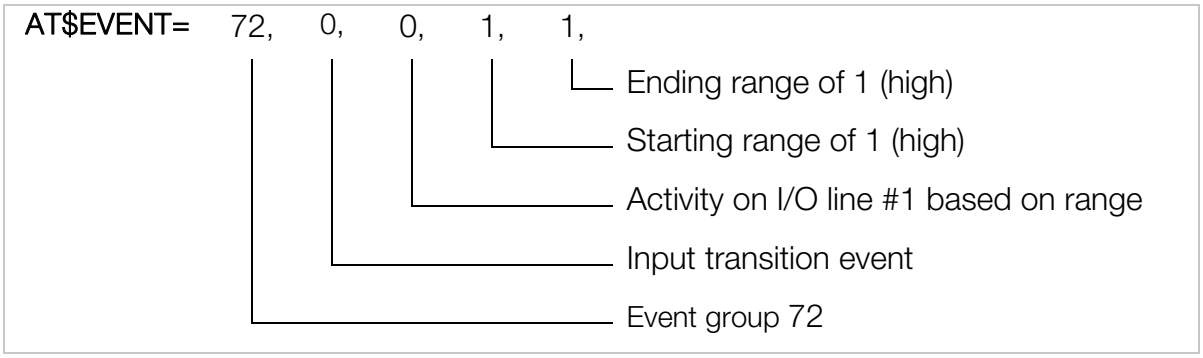
11 Panic Button Sample Design

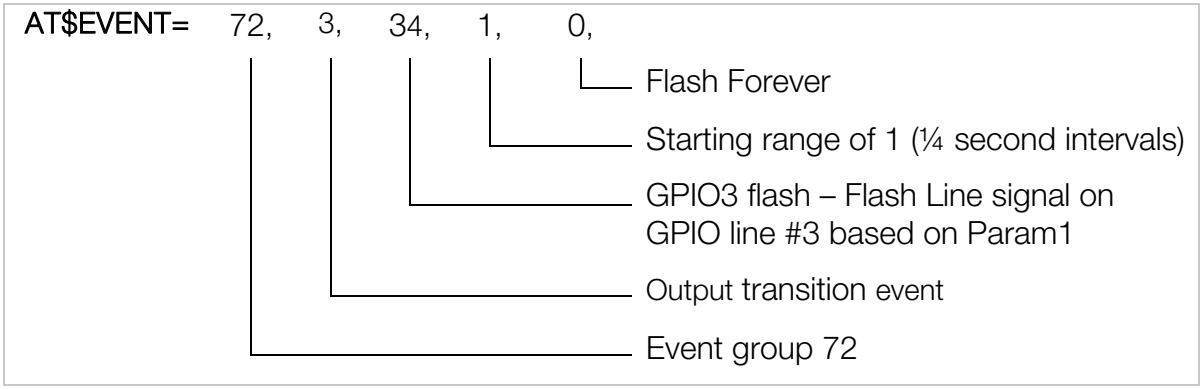
In this example the Enfora® Mobile Tracker will be configured to monitor a push button switch, flash a LED on switch closure, and send 10 additional messages to each server in the AT$FRIENDS list or until one of the servers sends an acknowledgment response back. A message must be sent from the server to turn off the flashing LED. This example requires access to a UDP server. If necessary, configure the modem per the appropriate quick start guide and use the Enfora Test Server.

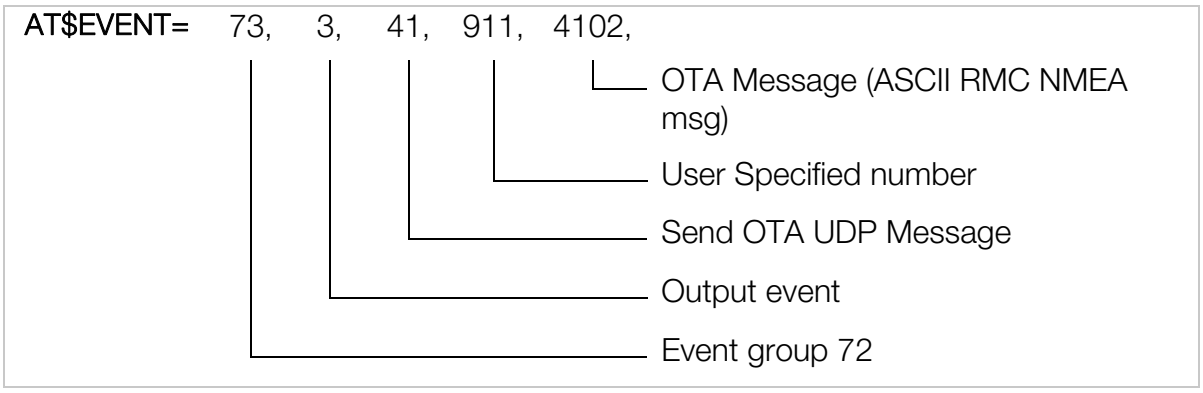
Configure the modem to send a message twice to each server, 5 seconds apart or until one of the servers sends the acknowledgement packet back.

AT$ACKTM=10,5,0

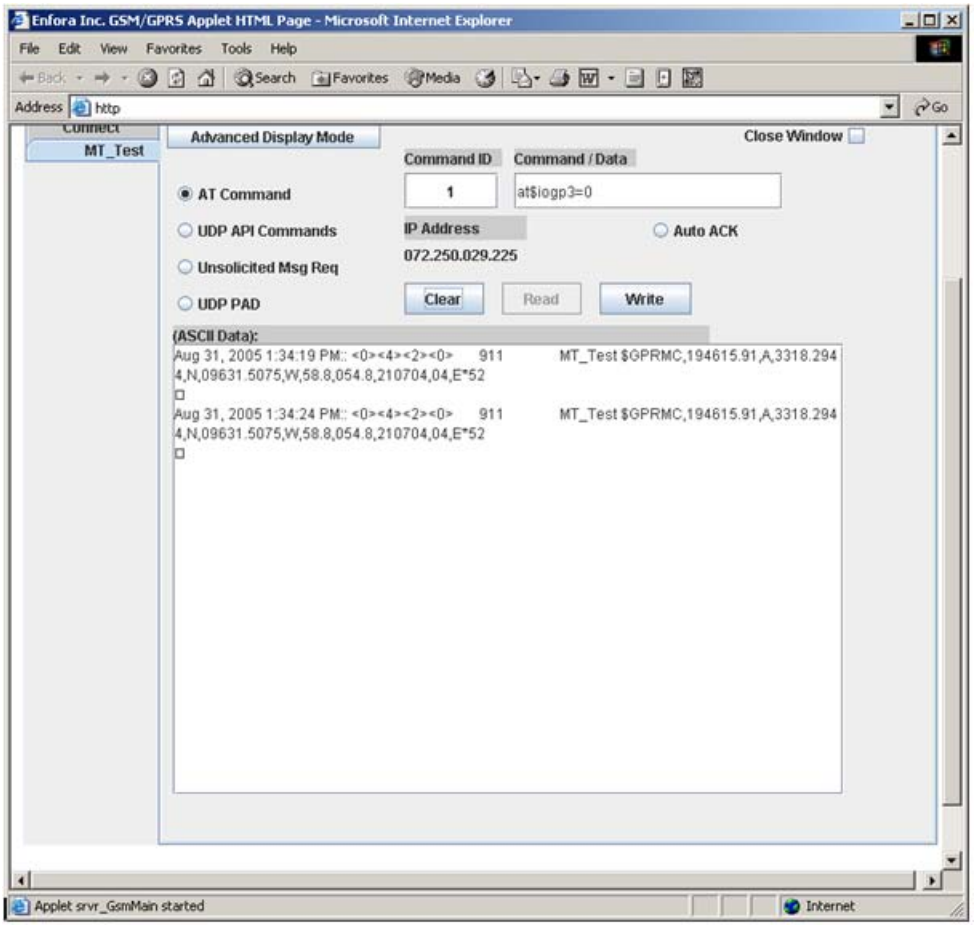
Add the following AT$EVENT commands.



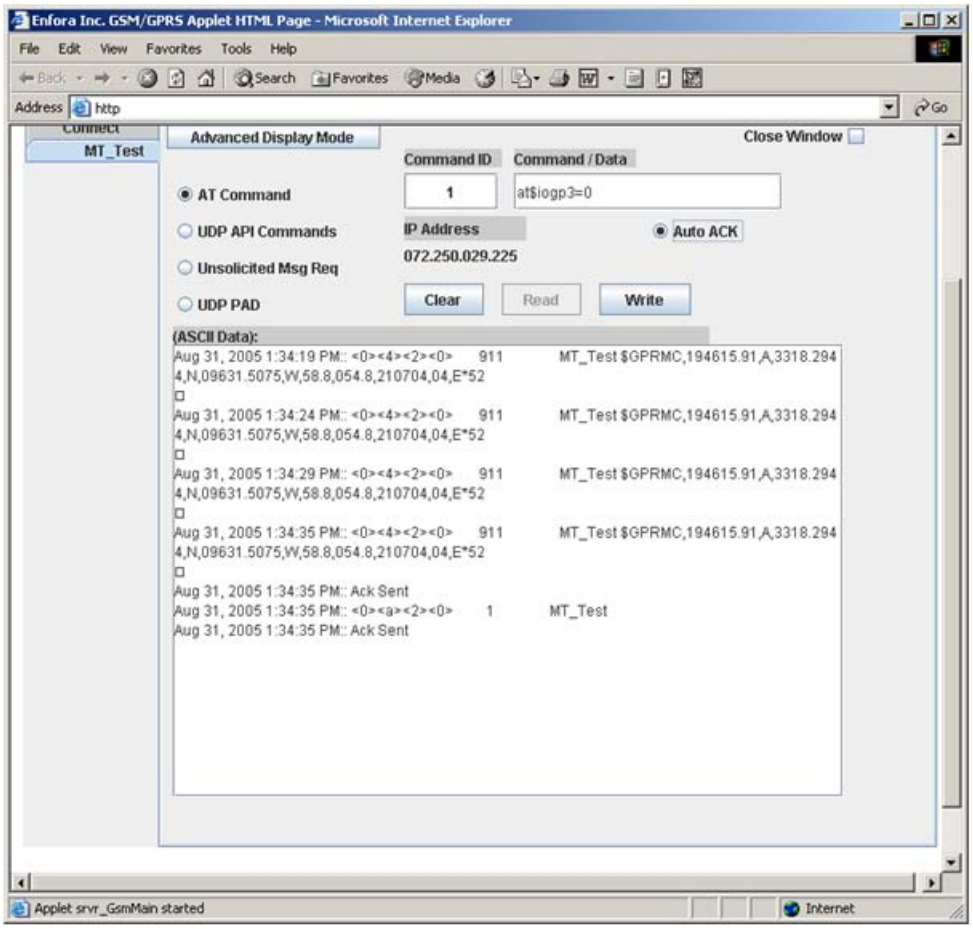




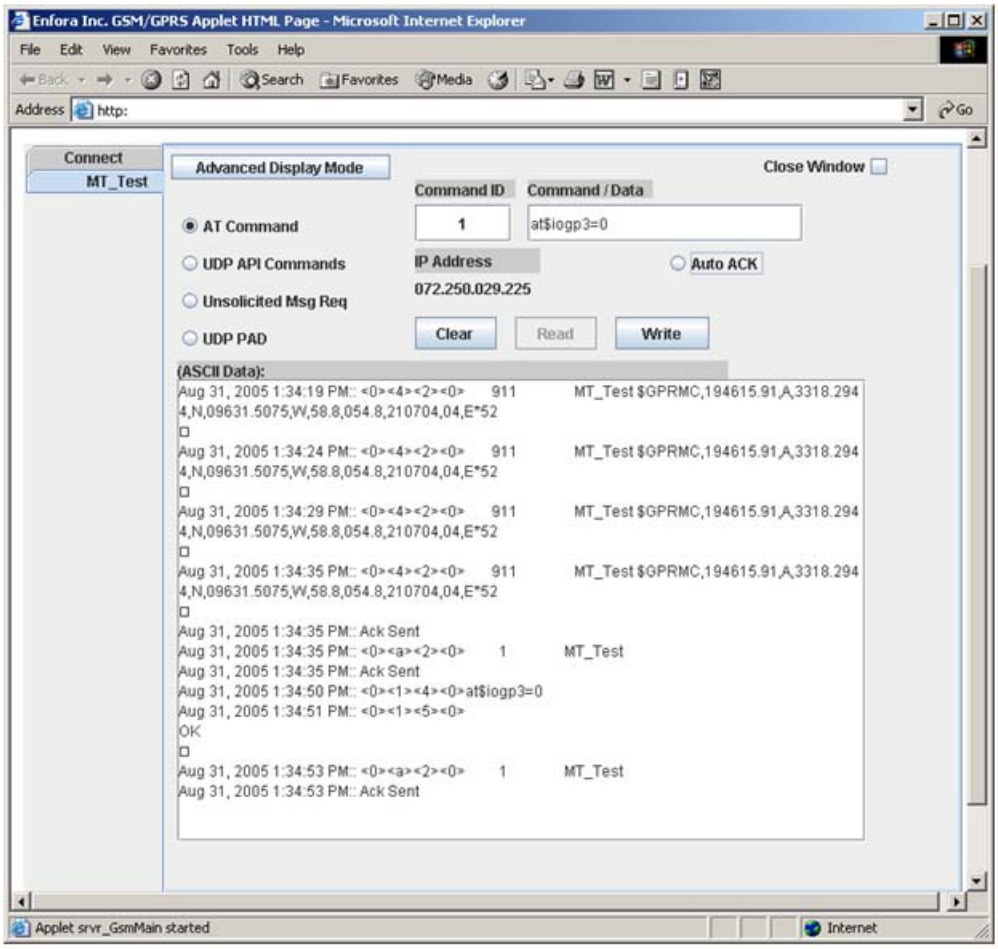
Press the “Panic” button on the Enfora® Mobile Tracker. The LED attached to GPIO 3 will begin to flash at ¼ second intervals. Also the Enfora® Mobile Tracker will start sending UDP messages as programmed in step 2.



After a couple of messages, enable the “Auto ACK” button. One more message should be sent and then the messages will stop.



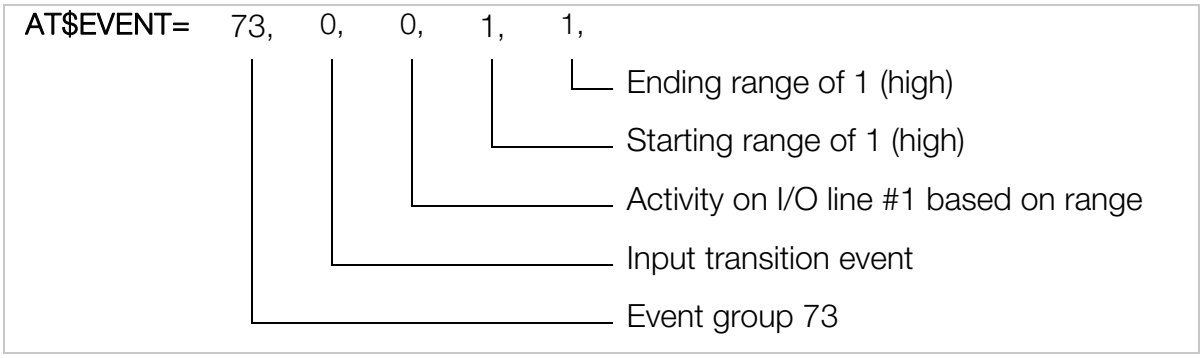
To extinguish to LED type in the AT Command AT$IOGP3=0 in the “Command/Data box. Click on the “Write” button to send the AT command to the Mobile Tracker. The LED attached to GPIO 3 will stop flashing.

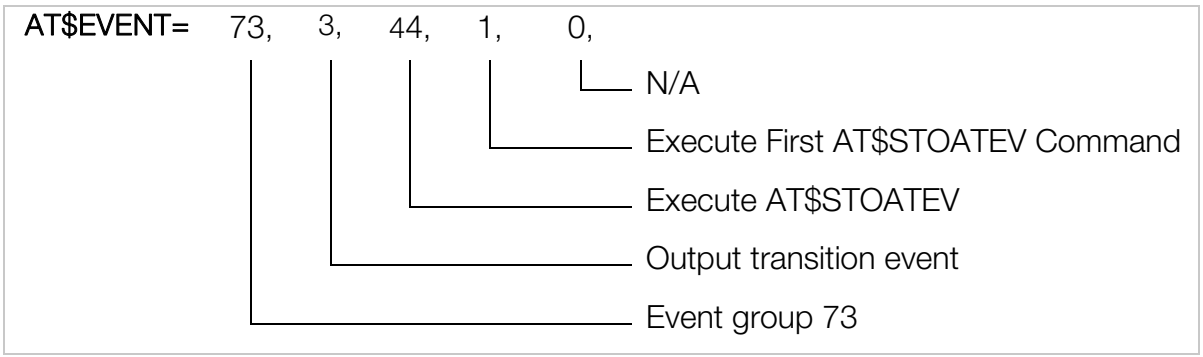

Enfora Inc. GSM/GPRS Applet HTML Page - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http:
Go
Connect
MT_Test
Advanced Display Mode
Close Window
Command ID
Command / Data
AT Command
1
at$iogp3=0
UDP API Commands
IP Address
Auto ACK
072.250.029.225
Unsolicited Msg Req
UDP PAD
Clear
Read
Write
(ASCII Data):
Aug 31, 2005 1:34:19 PM:: <0><4><2><0> 911 MT_Test $GPRMC,194615.91,A,3318.294
4,N,09631.5075,W,58.8,054.8,210704,04,E*52
Aug 31, 2005 1:34:24 PM:: <0><4><2><0> 911 MT_Test $GPRMC,194615.91,A,3318.294
4,N,09631.5075,W,58.8,054.8,210704,04,E*52
Aug 31, 2005 1:34:29 PM:: <0><4><2><0> 911 MT_Test $GPRMC,194615.91,A,3318.294
4,N,09631.5075,W,58.8,054.8,210704,04,E*52
Aug 31, 2005 1:34:35 PM:: <0><4><2><0> 911 MT_Test $GPRMC,194615.91,A,3318.294
4,N,09631.5075,W,58.8,054.8,210704,04,E*52
Aug 31, 2005 1:34:35 PM:: Ack Sent
Aug 31, 2005 1:34:35 PM:: <0><a><2><0> 1 MT_Test
Aug 31, 2005 1:34:35 PM:: Ack Sent
Aug 31, 2005 1:34:50 PM:: <0><1><4><0>at$iogp3=0
Aug 31, 2005 1:34:51 PM:: <0><1><5><0>
OK
Aug 31, 2005 1:34:53 PM:: <0><a><2><0> 1 MT_Test
Aug 31, 2005 1:34:53 PM:: Ack Sent
Applet srvr_GsmMain started
Internet

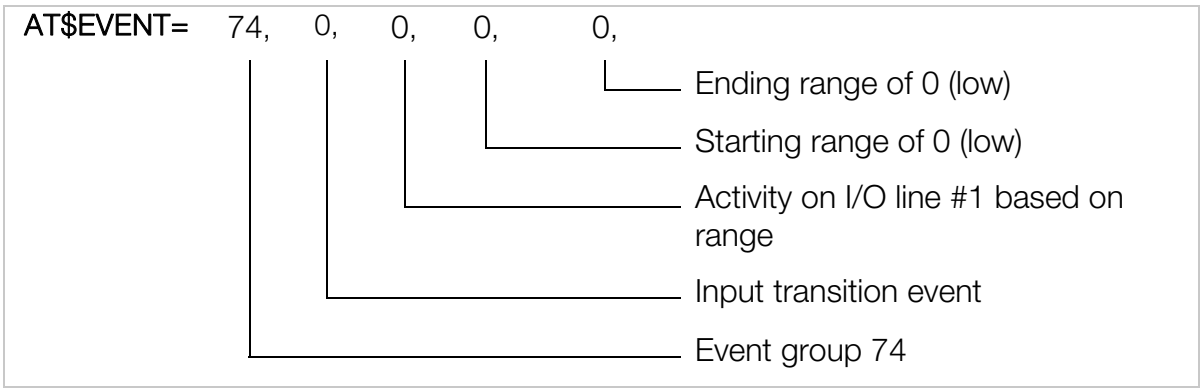
12 Door Switch Detect To SMS Message

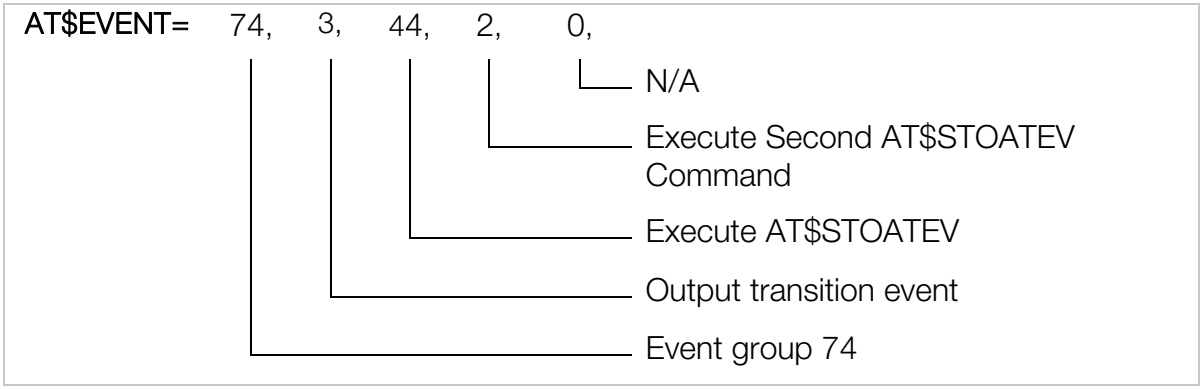
In this example the Enfora® Mobile Tracker will be configured to monitor a push button switch, such as the "door ajar" switch mounted on a vehicle, to inform the user via SMS messages on the state of the switch.

1. Add the following AT$EVENT commands to the Enfora® Mobile Tracker "Stock Factory Configuration."









2. Set the Enfora® Mobile Tracker's AT$STOATEV to send the "Door State" SMS messages.

```
AT$STOATEV=1, AT+CMSS=1
AT$STOATEV=2, AT+CMSS=2
```

3. Create the following SMS messages and save to the SIM card. Note: delete all SMS messages from the SIM card or take note of what message number is assigned to the stored SMS message. Then adjust AT$STOATEV accordingly. You can use a telephone number that can receive SMS messages such as a GSM cell phone or you can substitute the carrier's email gateway for the telephone number. See application note: GSM0000AN016 "How to Send an SMS Message to an E-Mail Address" for more information.

```
AT+CMGW="5555551212"
```

> Door Closed <CTRL-Z>

Note:This is message #1 as stored in the SIM Card.

```
AT+CMGW="5555551212"
```

> Door Open <CTRL-Z>

Note: This is message #2 as stored in the SIM Card.

4. Save the settings by using:

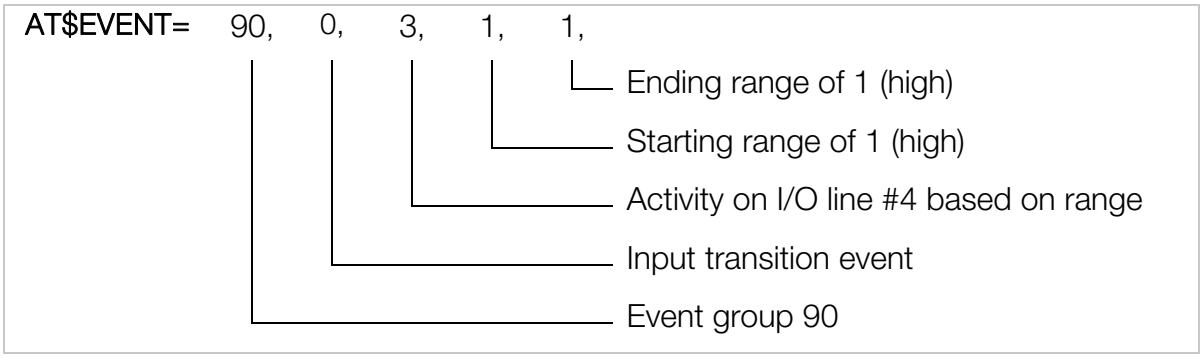
```
AT&W
```

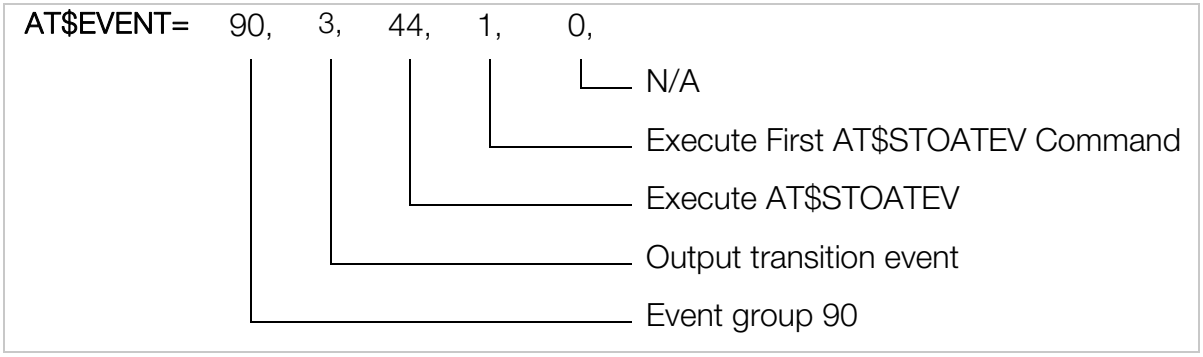
5. Reset the Modem and allow it to attach to the GSM/GPRS Network.
6. When the switch is pushed on the modem, it will send the SMS message stored in AT$STOATEV=2. When the switch is released the SMS message stored in AT$STOATEV=1.

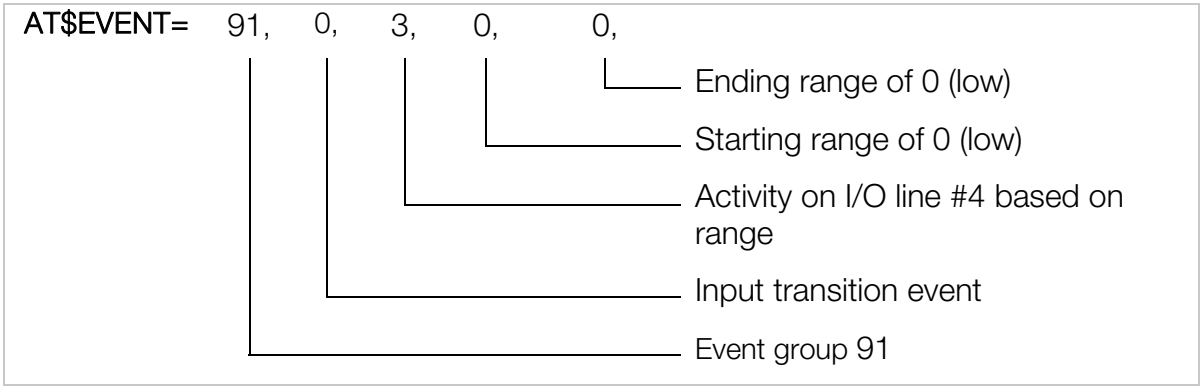
13 Events to Detect Primary Power Loss

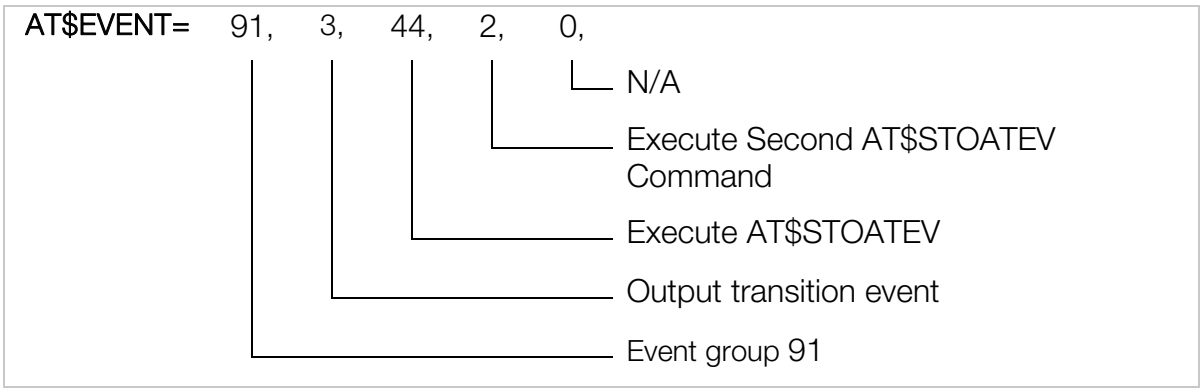
In this example the Enfora® MT-µL (GSM2238-00) will be configured to monitor and display to the terminal program, what power source it is currently running from.

1. Add the following AT$EVENT commands to the Enfora® Mobile Tracker "Stock Factory Configuration."









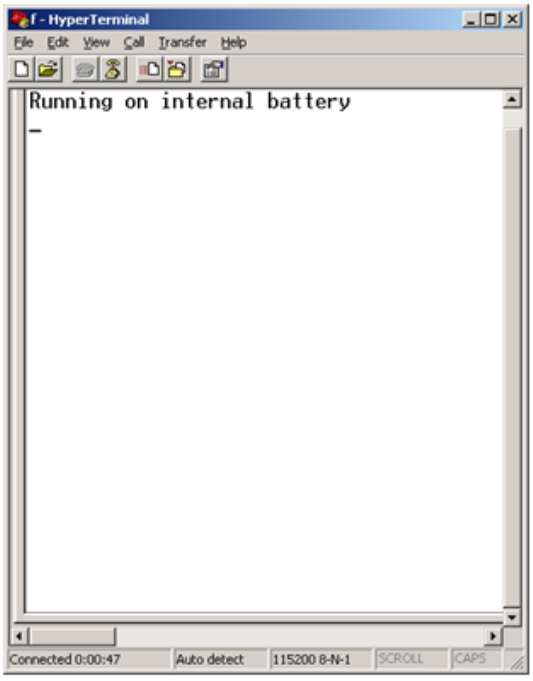
2. Set the Enfora® Mobile Tracker's AT$STOATEV to send the "Power State" via ASCII messages to the terminal program.

```
AT$STOATEV=1, AT$MSGSND=0,"Running on external power"
AT$STOATEV=2, AT$MSGSND=0,"Running on internal battery"
```

3. Save the settings by using:

```
AT&W
```

4. Turn the primary power supply OFF, the following message will be displayed from the Mobile Tracker.

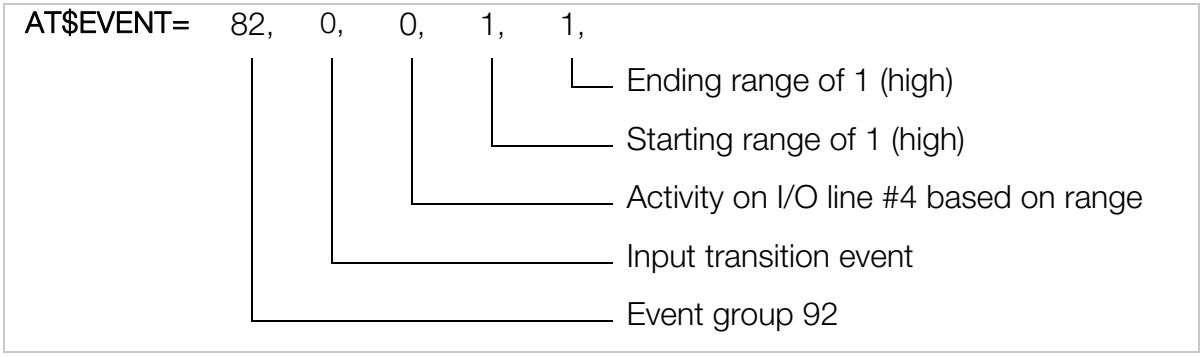


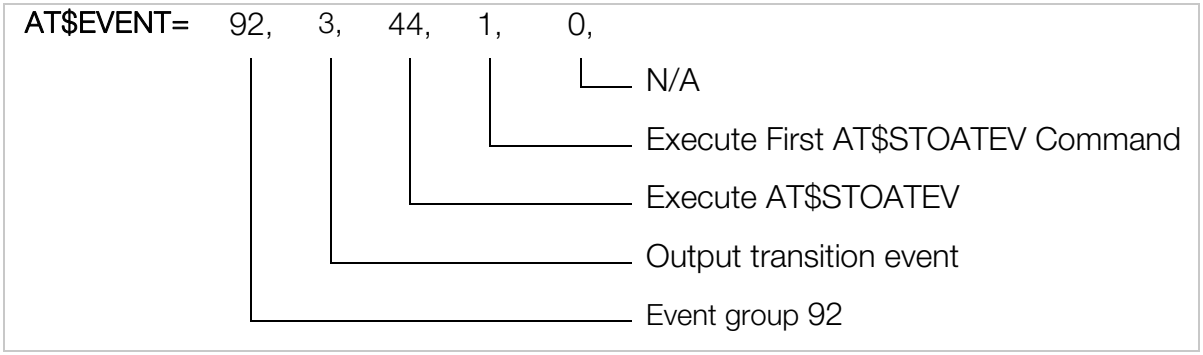
5. Turn the primary power supply ON; the following message will be displayed from the Mobile Tracker.

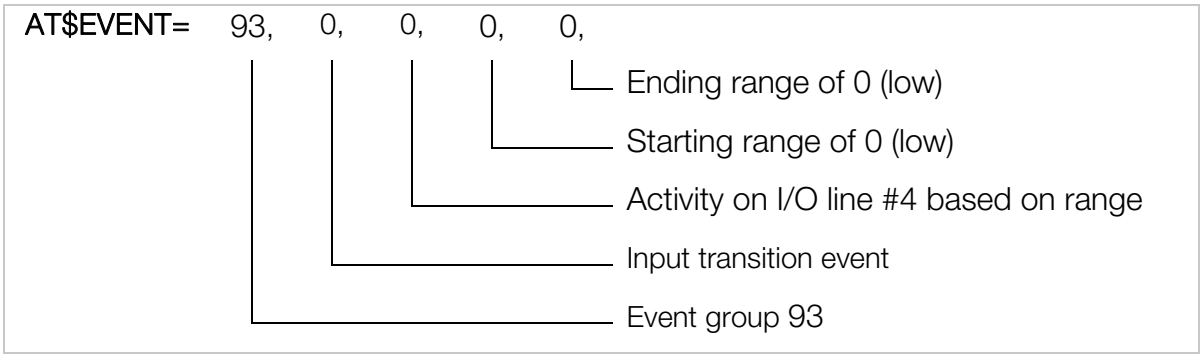
14 Events Biased on GPIO 1 ($IOPULUP)

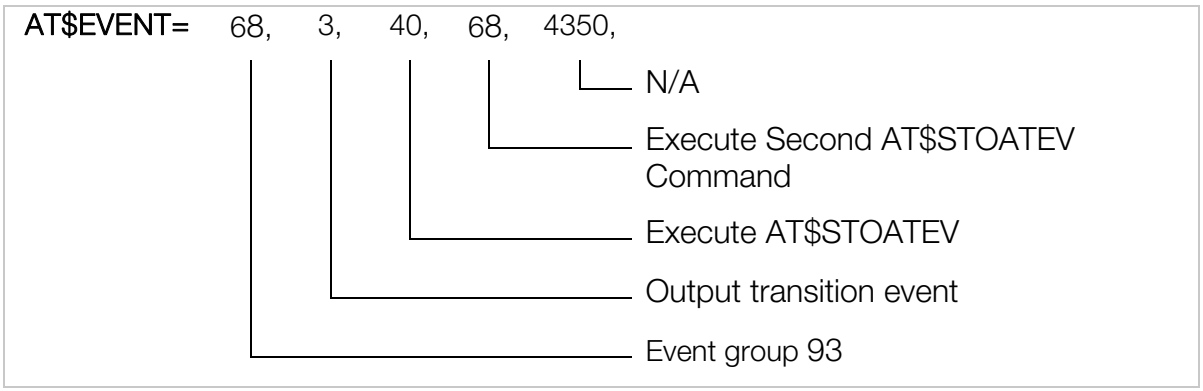
In this example the Enfora® MT-µL (GSM2238-00 or -01) will be configured to monitor and display to the terminal program, the logic state of GPIO 1.

1. Add the following AT$EVENT commands to the Enfora® Mobile Tracker "Stock Factory Configuration."









2. Set the Enfora® Mobile Tracker's AT$STOATEV to send the "Power State" via ASCII messages to the terminal program.

```
AT$STOATEV=1, AT$MSGSND=0,"GPIO 1 is in the HIGH State"
AT$STOATEV=2, AT$MSGSND=0,"GPIO 1 is in the LOW State"
```

3. Set the GPIO 1 pull-up to LOW by issuing:

```
AT$IOPULUP=0
```

4. Save the settings by using:

```
AT&W
```

5. Connect GPIO 1 to a positive power source; the modem will display the following in the terminal program.

6. Disconnect GPIO 1; the modem will display the following in the terminal program.